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AD NUMBER	
AD007783	
CLASSIFICATION CHANGES	
TO:	unclassified
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TO:	Approved for public release, distribution unlimited
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AUTHORITY	
31 Jul 1964, DoDD 5200.10; 17 Nov 1994 per AMCFI FOIA	

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Distribution authorized to U.S. Gov't. agencies only; Administrative/Operational Use; 31 MAY 1952. Other requests shall be referred to Army Deputy Chief of Staff [G-3], Washington, DC 20310.

AUTHORITY

31 Jul 1955, DoDD 5200.10; 31 Jul 1955, wpafb per DTIC Form 55

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REVISED
SUMMARY OF ORO PROJECTS
SPECIAL STUDIES
AND FIELD OPERATIONS
TO MAY 31 1952

VOLUME 1

OPERATIONS
RESEARCH
OFFICE

The Johns Hopkins University

28 JULY 1952

Operating Under Contract With
DEPARTMENT OF THE ARMY

SECRET
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20

53AA-2470

The Summaries contained in this
report cover ORO activities to
31 May 1952.

Revised: 29 July 1952

REVISED
SUMMARY OF ORO PROJECTS
SPECIAL STUDIES
AND FIELD OPERATIONS
VOLUME I

Operations Research Office
The Johns Hopkins University
6410 Connecticut Avenue
Chevy Chase, Maryland

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FOREWORD

The Operations Research Office of The Johns Hopkins University functions in accordance with AR 160-480, dated 30 June 1952, under a prime contract between the University and the Department of the Army, and reports to AC/S, G-3.

The following pages summarize briefly ORO's past accomplishments, its level of effort as of 31 May 1952, and its plans for the coming year. Readers should note that although the technical staff numbers one hundred as of 31 May 1952 it numbered sixty only a year earlier and started work for the Army with a very small group less than three years before that; most of the research reported here was undertaken by a small fraction of the present staff. Subcontractors and consultants have contributed as noted.

The technical staff is organized into seventeen continuing basic projects — staffed by research teams of two to twelve men, each with specified missions — the work and plans of which are summarized separately. In addition, two special studies (CLEAR and HUMAN BEHAVIOR) and three projects (ENVANAL, GUNFIRE, and MAID) have already been completed and are reported on here. Twenty studies in the Far East Command (eight sponsored by FEC, twelve by D/A) undertaken by the projects concerned are also reported. ORO's activities in the European Command and in England have been begun only recently and are not reported.

Of the seventeen basic projects, fifteen are grouped in five divisions of three projects each. Each division is supervised by a Deputy Director reporting to the Director. Two projects, BALANCE and OPSEARCH, are supervised by the Director himself, the former serves to guide and integrate the over-all program, the latter to abstract and develop basic methodology.

Each project assigned to ORO has been approved by both the Director of ORO and the Assistant Chief of Staff, G-3. Project Advisory Groups of four to ten officers representing interested divisions, sections, and agencies of the Army, have been appointed by AC/S, G-3 to provide information and guidance to the projects.

There is intentional overlap in some of the project missions in order to ensure coverage. Duplication of work is avoided by Deputy Director coordination, and by cross-project discussion, which is valuable for other reasons also.

The "balanced program" of operations research, represented by the seventeen continuing projects (possibly to be increased by one on airborne operations), is the result of over a year's study by ORO and the General Staff. The present project missions are considered broad enough to cover most Army operations requiring this type of research in the immediate future.

In each project report, item 7 is given as "Actions Believed Taken by the Army on the Basis of Study Results." This relates to such actions as are taken by the Army following the presentation of ORO conclusions and recommendations on a given project. These actions may not have been based solely on ORO studies and reports, because there are other significant factors which enter into decision-making at the Departmental and National levels. However, such actions are listed in this summary report as appear to be logically and consistently associated with the conclusions and recommendations of the ORO studies.

The content of item 13 has been deleted from each project report in this revised edition of the 1 July 1952 Summary of ORO Projects; it was included primarily for internal information within ORO. Reference to item 13 has been retained, however, to preserve the original structure of the book, thus permitting more rapid reprinting.

Conclusions and recommendations of early studies are reported herein as originally made without regard for modifications later developed. Certain conclusions and recommendations are in fact outdated and have been superseded; in particular, the conclusions of Project MAID (Volume II) should be viewed as of 1950.

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ORO PROJECTS

1. Project Name and Number:

ALCLAD (No. 99-49-4)

2. Assigned:

1 October 1948

3. Status:

All research work on Project ALCLAD is completed. The project will be formally terminated at such time as the final report, ORO-R-5, is distributed.

4. Mission:

The mission of this project is, based on the factors outlined in Paragraph 3, below, to obtain a scientific analysis of the whole problem of protection of the individual from the physical casualty-producing hazards of warfare. The analytical study shall include all means (exclusive of collective or multiple person protective devices or structures) by which the individual may be protected from missiles or fragments of missiles; concussion resulting from explosion; radiation from nuclear fission or from the products therefrom or from induced radioactivity; pathogenic agents; chemical agents; disease bearing vectors; heat radiation; and flaming agents. Due consideration should be given to protection from the above agents in frigid, temperate, and tropical climates. The study should result in specific recommendations for future research on, development, and use of the optimum protective equipment and systems for the protection of the individual. (Camouflage of the individual is also construed as a protective means.)

5. Major Conclusions:**a. Missiles and Missile Fragments:**

(1) Other than the helmet, the provision of body armor on a general issue basis to the army combat team as a means of protecting combatants against battle missiles is militarily impractical.

(2) The weight of body armor necessary to provide any gain would decrease the battle effectiveness of the combat soldier. Because analysis shows a requirement to reduce currently prescribed combat loads carried by the soldier and the difficulties in eliminating or reducing the weight of present equipment, no chance is offered to include body armor without seriously decreasing battle effectiveness. This conflict cannot be solved by research directed only toward the development of light weight armor materials.

(3) Re-design and re-location of individual combat equipment for added protection is less profitable than new designs directed toward reduced interference with mobility and military efficiency.

(4) For military specialists other than infantry, whose duties demand less physical activity, truck armor might be applicable if field logistic problems can be solved. For Air OP personnel and possibly vehicle drivers, body armor might be of military value.

(5) For personnel performing highly hazardous tasks such as mine clearance, body armor would provide small gains if it did not interfere with task performance and ability to take evasive action.

(6) The portable armor shield would not be an acceptable device in lieu of body armor.

(7) The armor helmet is a device of very great military value.

b. Toxic Agents: Chemical, Biological, and Radioactive:

- (1) Protecting the eyes, respiratory system, and alimentary tract against chemical, biological, and radioactive agents is a primary requirement in individual protection against these hazards.
- (2) The introduction of new toxic agents which can cause casualties more rapidly than they can be detected sets up a requirement for protective equipment which can be worn for many hours.
- (3) The present standard US Army gas mask, M9, is technically adequate to provide good protection to the eyes, respiratory system, and alimentary tract against airborne toxic agents, if it is properly fitted and adjusted.
- (4) The M9 Type of mask prevents high physical activity, but can be worn for long periods of time when only a low level of activity is required.
- (5) An urgent requirement exists for a mask which provides adequate protection against all military toxic agents and which does not seriously decrease the wearer's combat capabilities.
- (6) Regular combat clothing in two or more layers provides good protection to the parts of the body covered against airborne biological and radioactive agents, but offers no protection against mustard and some other chemical agents.
- (7) There is a requirement for whole body protection against mustard as vapor and as liquid.
- (8) Data are needed on the toxicity of liquid and gaseous G-agents to man, through the skin, to determine if there is a requirement for protective clothing against these agents.

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ALCLAD

(9) Regular HBT clothing impregnated with CC-2, and with openings properly closed, provides considerable protection against mustard vapor but almost none against liquid mustard.

(10) A hood is the most practical means of protecting the head and neck against all toxic agents. Gloves are required for protection of the hands.

(11) The present US Army supply of equipment for protection against toxicological warfare is seriously inadequate.

c. Thermal Radiation and Flame:

(1) Regular army clothing of cotton or wool offers a significant degree of protection against burns on the covered parts.

(2) Because of their frequency and severity, burns on the exposed members, the face and hands, constitute the major losses in burn injuries among ground troops.

(3) Protection for these regions can be accomplished by the wearing of gloves and hoods of cotton or wool; since gloves are standard equipment and since gas mask hoods have been recommended for use against CW agents, no new or novel device will be required for protection against heat.

(4) If the face and hands are not protected, flame-proofing treatments on regular clothing will not offer any gains by reducing the total burn casualties or reducing the term of incapacitation for hospitalized burn cases.

(5) If gloves and hoods were worn, flame-proof treatments probably would offer slight gains against the flame hazard only by reducing the severity of injury or preventing a fraction of the burns occurring on the covered skin. To be considered as weighing against these slight gains are the casualties resulting from other agents where inferior wearing qualities due to the treatment would decrease the protection offered by clothing against RW, BW, and CW.

(6) For protection against the edge effects of flaming weapons, a poncho-type device is desirable.

(7) Since flame-proofing already has useful military applications in the treatment of tentage and paulins, research efforts should continue to pursue the field with positive objectives in mind to develop methods of flame-proofing which overcome the important losses in fabric properties connected with current methods.

d. Insects:

(1) A method should be developed whereby suppressive drugs can be administered routinely in the field in a way which will prevent men from circumventing treatment.

(2) Methods should be developed which will control the hazards of insects for long periods of time with less logistical cost than current methods.

6. Recommendations:

- a. Other than armor helmets, the general provision of body armor to ground combat troops is not recommended.
- b. Operational field tests in combat areas should be carried out to determine the practicability of body armor for military specialists other than infantry.
- c. The greatest possible effort should be given to the solution of the highly important problem of reducing the combat load of the soldier.
- d. Military policy should continue to include the armor helmet as an item of general issue.
- e. The helmet should be redesigned to provide increased coverage over the cranial region. NO sacrifice in frontal coverage to allow the use of sighting equipment should be made in helmets for infantry.

- f. **Fundamental research on the relationship between the structure of materials and their ballistic properties should be carried out. Small gains from such a program could lead to significant improvements in the helmet.**
- g. **A program of indoctrination should be instituted to impress troops with the value of the helmet in preventing casualties.**
- h. **Field and operational studies on the offensive aspects of toxicological warfare should be carried out.**
- i. **Field tests should be carried out on the dissemination of toxic agents under low temperatures.**
- j. **Research directed toward the development of a light gas mask, permitting high levels of physical activity and suitable for nearly continuous wear, should be continued and accelerated.**
- k. **Soldiers should learn to use the gas mask by wearing it frequently during normal training exercises, with exposure without warning to tear gas and other slightly toxic agents.**
- l. **Procurement of gas masks must be accelerated.**
- m. **Research on general-purpose combat-clothing-protection against mustard as vapor and as liquid should be carried out.**
- n. **Experiments should be carried out designed to determine casualty-producing dosages of liquid G-agents acting through the skin and the degree of protection afforded by clothing.**
- o. **A hood and gloves designed for protection against toxic agents, heat, and flame should be items of general issue.**
- p. **Training and discipline in the use of the hood and gloves by troops exposed to flame, heat, and toxic agents should be emphasized if gains are to be made.**

- q. To provide a basis for selection, fundamental research should be carried out to determine the factors which govern the resistance of clothing materials to thermal radiation and flame.
- r. Studies are necessary to determine the biomedical aspects of thermal flash burns from atomic weapons in relation to burns resulting from contact with heated clothing, and in relation to the layer principle of protection.
- s. Since flame-proof treatments already have useful military application in the treatment of tentage and paulins, research in this field should continue.
- t. Though the broad program of the army in research and development in the field of insect protection and control is sound, basic research could be emphasized in insect physiology and on the mechanism of disease transmission by insects.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. ALCLAD studies showed the necessity to determine the minimum incapacitating dosage level of G-agents for man. Experiments in this direction have been conducted which parallel early suggestions of the ALCLAD Project Group.
- b. Suggestions were made for conducting animal experiments to determine the effect of activity on lethal dosage of G-agents. These experiments have been carried out.
- c. ALCLAD studies showed the importance of developing new light type gas masks which would have less severe effects in reducing human capabilities in high activity. New design principles in masks are already under development and have been encouraged by the ALCLAD group.
- d. ALCLAD has proposed experimentation with men wearing type M9 masks in atmospheres containing G-agents. These

experiments have been conducted with important fundamental results pertaining to protective evaluation of these masks.

- e. The analysis on armor helmets under Project ALCLAD has influenced the armor helmet development program.
- f. Early ALCLAD studies on infantry casualties and tactics have shown the necessity to expend effort in reducing the combat load of the soldier, and improving his battle capabilities by improvement in weapons and personal equipage. A new Project DOUGHBOY has been initiated and approved for ORO study by the Department of the Army.

8. Publications:

- ORO-T-5 Special Report to Maj. Gen. K. D. Nichols (TOP SECRET)
- ORO-T-12 A Review of the Body Armor Situation (SECRET)
- ORO-T-14 Radioactive Contamination (CONFIDENTIAL)
- ORO-T-17 Effects of Atomic Bombs on Civil Life (RESTRICTED)
- ORO-T-34 An estimate of the Probable Savings in Infantry Battle Casualties Afforded by Body Armor Assumed to Offer Perfect Protection Against Missile Fragments (SECRET)
- ORO-T-60 Military Potential of GB (SECRET)
- ORO-T-69 USSR Capabilities in Chemical Warfare (SECRET)
- ORO-T-85 Armor Helmets (SECRET)
- ORO-R-5 ALCLAD Final Report "Protection of the Soldier in Warfare" (SECRET) (Draft Report Completed 1 Aug 51)

9. Staff Members:

John H. Gardner
Norman A. Hitchman
Robert J. Best

10. Subcontractors:

Midwest Research Institute

11. Consultants:

None

12. Plans for FY53:

The ALCLAD analysis on toxic agent warfare has pointed up the vital necessity to conduct broad and comprehensive studies in the offensive aspects of these agents. Project COBRA has been approved for ORO study by the D/A and this project will include the broad area of effort to be studied in offensive BW, CW, and RW. COBRA is currently attacking these problems.

13. Contents of this item deleted.

1. Project Name and Number:

ANALAA (No. 99-48-1)

2. Assigned:

25 August 1948

3. Status:

Current. A general report is in preparation. This report will summarize some of the studies which have been performed within Project ANALAA during the last three years. Such studies as weapons-effectiveness evaluations will be presented on a common basis and integrated with the ORO vulnerability studies. As the ANALAA staff is very limited, it is difficult to predict when the draft of this report will be prepared, although it is hoped that it will be completed before the end of autumn.

Other tasks under way or in the planning stage include:

- a. An evaluation of the 127/60-mm weapon of the London Conference Family of AA Weapons;
- b. Continuation of the study of the ZI vulnerability to atomic bombing;
 - (1) Daytime population mortality
 - (2) Effects of civil defense measures
- c. European vulnerability to atomic bombing;
- d. A study of the best atomic warhead for AA guided missiles;
- e. A study of AA radar characteristics;
- f. A study of the comparative values of various surface-to-air guided missiles with particular emphasis on NIKE and TERRIER;

- g. A study of the value of the NIKE Systems Tester as a NIKE flight simulator, in increasing the knowledge derived from actual NIKE flight tests.

4. Mission:

The mission, as originally stated, was "To obtain a scientific analysis of the whole antiaircraft problem. The analytical study shall include all means (exclusive of piloted aircraft) to destroy enemy aircraft and missiles in flight and should result in specific recommendations for future research, development and use of the optimum weapons, equipment and systems for AA defense."

By letter (G-3 452 26 Feb 1952) the ANALAA mission was extended "to include such incidental analysis of piloted aircraft as pertains to effectiveness and cost relation with respect to defense from the ground."

5. Major Conclusions:

- a. Where complete freedom of maneuver is granted the attacking aircraft, little effectiveness is obtained from predicted-fire weapons at times of flight greater than about ten seconds. If the aircraft is restricted to straight and level flight some effectiveness is obtained to the limit of coverage.
- b. Great improvements in predicated-fire weapons will be obtained if they are designed for high cyclic rate or salvo fire so that engagement can be undertaken at the period of highest kill probability.
- c. If guided missiles fulfill their promised performance with respect to accuracy, warhead lethality, reliability, and cost, from the standpoint of military effort and economy, the use of guided missiles rather than predicted-fire weapons is essential for medium and high altitude attacks.
- d. Integrated fire control systems offer much less advantage for low kill probability weapons than for high. In other

words, any justification for such systems must be found in guided-missile control rather than gun control.

- e. In common with other branches of the Service, a marked increase in demand for technically qualified maintenance personnel is being created in antiaircraft artillery by materiel now under development.
- f. With the exception of one or two industries, the US industrial plant would be relatively unaffected by sporadic enemy air attacks, even by atomic weapons. It would take more than ten atomic bombs of 80 KT size, accurately placed on carefully chosen targets, to produce even a 10 percent reduction in war industrial capacity. To effect a 50 percent reduction, 165 such bombs would be required. However, the human casualties resulting from even a small number of bombs would be in the millions in the absence of specific civil-defense precautions.

6. Recommendations:

- a. The development of new predicted-fire weapons should be limited to high cyclic rate and salvo types designed for use at times of flight under ten seconds. This means, specifically, light automatic guns and salvo rocket projectors of relatively short range. However, until guided missiles are operable, reasonable numbers of heavy guns should be kept in service.
- b. Every effort should be made to accelerate the development and early issuance of reliable and accurate surface-to-air guided missiles.
- c. The design of new weapons should weigh heavily the demands made on maintenance in relation to the whole technically qualified manpower supply available.
- d. The effects of passive defense measures, both in the theater and in the ZI, should be carefully analyzed. It is possible,

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ANALAA

particularly in the ZI, that more is to be gained, per dollar expended, by passive measures than by active AA defense, thus releasing manpower and materiel for offensive operations against the enemy.

- e. The study of atomic anti-aircraft weapons should be actively continued, paying particular attention to the optimum weapon size, tactics, and means of delivery.
 - f. Research and development of "arrow-type" weapons such as the 90/40-mm should be continued, but production is not to be pushed at this time. The detailed survey of the vulnerability of major US metropolitan areas, both for industrial damage and mortality, is contained in ORO-R-10.
7. Action Believed Taken by the Army on Basis of Study Results:
- a. The Consultant (Millar) Group on the 414A Integrated Fire Control System adopted the recommendation regarding the fail-safe requirement put forth in a briefing by Project ANALAA (ORO-S-87). They also adopted our conclusion that provision for battery-to-battery data transmission through the Fire Direction Center imposed objectionable restrictions on the system.
 - b. The Project CHARLES group accepted ANALAA recommendations regarding time of flight restrictions and salvo-fire recommendations for predicted-fire weapons. (ANALAA briefings at CHARLES [ORO-S-100 and ORO-S-161], and letter to CHARLES 19 April 1951,) In fact, the CHARLES group accepted almost all of the recommendations made by Project ANALAA in past memoranda, briefings, and so forth, all of which were made available to them.
 - c. Judged by the results of a recent ORO survey of graduates of the training courses at Fort Bliss, the Army is making a successful effort to retain graduates in the specialties for which they have been trained. This is believed a consequence of past ANALAA recommendations.

- d. Production of arrow-type projectiles is not being pushed, although development is continuing.
 - e. ORO has been urged, as a result of our original atomic AA study (ORO-T-131) to continue this work, paying particular attention to determining the best means of delivery of atomic AA weapons.
 - f. Continual requests have been made of ANALAA personnel for scientific advice, briefings, lectures, conferences, and so forth, by the various General Staff subdivisions and D/A branches concerned with AA, as well as by other agencies in the Defense Department, the Federal Civil Defense Administration, the National Security Resources Board, and the Atomic Energy Commission. It has been our pleasure and privilege to comply with these requests, and it is believed that considerable assistance has been rendered the over-all national defense in this manner, although it is, of course, difficult to pinpoint specific actions proceeding from such activities.
8. Publications:
- ORO-R-10 US Concentrations of Industry and Population as Target Systems (SECRET - SERIAL DOCUMENT)
 - ORO-T-3 A Review of the Current British Antiaircraft Defense Analysis (SECRET)
 - ORO-T-4 Survey of AAA Materiel (SECRET)
 - ORO-T-6 Tactical Employment of AA Weapons, Part I (SECRET)
 - ORO-T-8 The Significance of Antiaircraft Artillery and the Fighter Arm at the End of the War (WITHDRAWN - Circulated as a Special Document)
 - ORO-T-16 Effects of Evasive Action on Fire Control Systems (SECRET)
 - ORO-T-31 Notes on the Economics of Air Defense (SECRET)
 - ORO-T-35 Appraisal of Passive Defense Measures for Reducing the Vulnerability of Industrial Plants, Part I (SECRET)

- ORO-T-38 Petroleum Industry: The Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-39 Areas to be Defended Against Attack by Air (SECRET)
- ORO-T-40 The Labor Force: The Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-42 Over-all Effectiveness of First US Antiaircraft Guns Against Tactical Aircraft (SECRET)
- ORO-T-45 V-1 and V-2 Attacks Against the UK During World War II (SECRET)
- ORO T-48 Appraisal of Passive Defense Measures for Reducing Vulnerability of Industrial Plants to Air Attack, Part II (SECRET)
- ORO-T-49 Progress Report, Fourth Quarter 1949, Curtiss-Wright (SECRET)
- ORO-T-52 The Value of Tactical Air Support (WITHDRAWN)
- ORO-T-53 Vulnerability of Typical Soviet Ground Support Aircraft to Cal .50 and 40-mm Fire (SECRET)
- ORO-T-55 The Machine Tool Industry: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-56 The Transportation Industry: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-57 The Electric Power Industry: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-58 The Light Metals Industry: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-63 The Vulnerability of Personnel to Instantaneous Ground Burst Bombs (SECRET)
- ORO-T-64 The Vulnerability of Soft Vehicles to Instantaneous Ground Burst Bombs (SECRET)
- ORO-T-71 Losses of German Mine-laying Aircraft Operating Against English Ports (SECRET)
- ORO-T-80 Serpentine Evasion Courses: Relationship Between Fire Control Errors and Extra Travel by Target (SECRET)
- ORO-T-81 Impact of Strikes of US Industrial Activity (SECRET)
- ORO-T-87 Vulnerability of Industrial Plants to Air Attack (SECRET)

- ORO-T-90 The Communications Industry: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-91 Community Facilities: Effect of Bomb Damage on War Potential (SECRET)
- ORO-T-92 Areas To Be Defended Against Attack by Air (SECRET)
- ORO-T-93 Preliminary Evaluation of Skysweeper (SECRET)
- ORO-T-96 Special Air Defense Study (SECRET)
- ORO-T-100 Production Costs and Expansibility of Skysweeper (SECRET)
- ORO-T-101 Production Costs and Expansibility of the T-33 Antiaircraft Fire Control System (SECRET)
- ORO-T-103 Production Costs and Expansibility of the Project 414A Fire Direction Center System (SECRET)
- ORO-T-111 Production Cost and Expansibility of the Antiaircraft Missile LOKI (SECRET)
- ORO-T-112 Production Cost and Expansibility of Stinger (SECRET)
- ORO-T-114 40-, 90-, and 120-mm Antiaircraft Guns and Associated Fire Control (SECRET)
- ORO-T-131 A Preliminary Study of Atomic Antiaircraft Weapons (SECRET - RESTRICTED DATA)
- ORO-T-147 Regional Concentration of War Industry and Population in the US (SECRET)

Reports by subcontractors in process or to be incorporated in ANALAA General Report:

One or more reports on ZI vulnerability (SRI)
One report on NIKE/120-mm comparison (B-A-H)

Total reports in process	3
Total technical memoranda	39
TOTAL	42

9. Staff Members:

Present:

James H. Henry, Chairman
Col. S. I. Gilman, Vice-Chairman

William G. Street) Project DONKEY, assisted
William F. Druckenbrod) in guided missile studies

Now assigned to other projects:

Macon Fry (Ex-Chairman)
Henry P. Griggs

No longer with ORO:

Ervin H. Bramhall (Ex-Chairman)
Dwight Garrison
Francis Strabala
P. B. Mansfield
B. E. Phillips
R. E. Eldridge
J. P. T. Pearman

10. Subcontractors:

Battelle Memorial Institute - W. L. Swager
American Power Jet Company - George Chernowitz
Stanford Research Institute - Bonnar Brown, W. J. Platt
Columbia Research & Development Corp - H. O. Kempton,
W. A. Gunn

Snow & Schule, Inc. - Robert Snow
Curtiss-Wright - Oscar T. Schultz
Cornell Aeronautical Laboratory - Dr. Mark Foster
Dunlap & Associates, Inc. - Jack W. Dunlap and Jesse Orlansky
Boos, Allen and Hamilton - Rune Evaldson, J. W. Pocock

11. Consultants:

Macon Fry (now ORO member)
Kenneth G. Merriam
Ernest Pollard
Arthur Jones
B. M. Holden
R. P. Morrissey
S. W. Marshall
Floyd Ulrich
Louisiana Polytechnic Institute Group (Roy T. Sessums, et al)

12. Plans for FY53:

- a. Project ANALAA is preparing a report which would indicate the cost of defense by various AA weapons, both conventional and guided missiles, at attrition rates and attack altitudes. This study will be combined with the vulnerability studies already completed to indicate the cost of ZI defense against enemy aircraft. It is hoped that this will be completed by the autumn.
- b. Vulnerability of ZI to atomic bombing will be completed for mortalities in daylight hours.
- c. The vulnerability of various European countries to atomic bombing will be completed. The study of optimum atomic warheads will be continued. A report should be available by late autumn.
- d. Studies will be continued on the applicability of the NIKE Systems Tester for NIKE Flight Simulator and its value for the NIKE Test Program.
- e. It is hoped to initiate studies to determine the performance of antiaircraft radar, particularly against groups of aircraft.

13. Contents of this item deleted.

1. Project Name and Number:

ARMOR (No. 99-50-10)

2. Assigned:

28 September 1950

3. Status:

Current

4. Mission:

The mission of this project is to study armored warfare to ascertain armor's probable role in a future war, especially as it may be affected by current trends in technology and tactics, new tank and antitank weapons, and new methods of their employment.

5. Major Conclusions:

a. Land Mines:

(1) In World War II and in Korea, land mines are effective weapons.

(2) In a future war, land mines will continue to be potent weapons against tanks, transport vehicles, and personnel.

(3) Current US mines are obsolete.

(4) Technical knowledge already available is sufficient to predict that in one year, with a "crash" Research and Development program, the US could have more effective mines with influence fuzes, speedy installation

methods, by machines, air, artillery and rockets, to give mines both offensive and defensive capabilities.

b. The Cobra:

(1) No progress has been made in light, tracked vehicles design since 1915.

(2) Very important improvements in mobility—increased average cross - country speed, reduction of the effects of vehicle sinkage especially in "soft" terrain, better obstacle and ditch crossing can be obtained by a number of design innovations.

(3) These innovations include a spaced-link track, a powered obstacle track, a bellyless design, an increased length to width ratio, and articulated steering.

(4) Savings in production costs and operational cost may be anticipated.

(5) The Cobra design can be modified to act as a universal vehicle-personnel carrier, cargo carrier, command and communication vehicle, flame thrower, light AA and automatic weapons carrier, etc.; and especially, mounting 105-mm recoilless rifles, up to four, be effective as an infantry battalion antitank weapon.

c. Detectability of Land Mines by Air-Photo:

(1) Various conclusions on detectability related to soils and mine patterns.

d. Survey of Allied Tank Casualties:

This study is essentially for background use, leading to prediction capabilities of tank casualties in a future war, weapons effectiveness and logistics and replacement planning.

e. Armor Study in FEC:

(1) Tanks are an important part of the Army's forces.

(2) Over-all, the M4 was the best tank for the specific job in Korea. This tank, the M26, and M46, were

superior to the Soviet T34/85 as manned and used by the North Koreans.

(3) Mechanical reliability of all tanks, but especially the M46, was unacceptable. About 60 percent of all casualties were due to this cause; 16 percent due to mines and 24 percent to all other causes.

(4) Night fighting capabilities of our armor were inadequate.

(5) Communications between tanks and infantry and battalion CPs were deficient.

(6) Use of tanks in the antitank role and for convoy protection was uneconomical.

(7) The Air Force accounted for about 42 percent of all enemy tank casualties, with napalm being its most effective weapon. There is reason to believe that the effectiveness of napalm can be reduced by the enemy by appropriate technical and training changes. Army forces were credited with 24 percent, and all others (including abandonments and unknown) were 34 percent. Of this latter group, Army forces, by virtue of tactical successes, can be credited with a major portion.

(8) Land mines were the most effective weapons of the enemy, causing 155 casualties or 16 percent; NK laying methods, especially random use, were crude but effective. US use of mines was poor to mediocre in effectiveness; there is evidence that the Land Mine study which recommended more effective mines, including offensively-laid mines, would have paid off in Korea.

6. Recommendations:

a. Land Mines:

(1) An immediate "crash" Research and Development program at a 6,000,000 per year level to develop a family of mines.

- (2) A panel of officers to study new tactical uses.
 - (3) Consideration of massive use of mines for the defense of Western Europe.
 - (4) Initiate new training programs in mine warfare which will indoctrinate senior officers and offer improved training techniques to enlisted men.
- b. The Cobra:
- (1) Prototypes of several types should be developed immediately.
 - (2) Further basic study is needed to relate terrain and soil textures to both tracked and wheeled vehicles.
- c. Detectability of Land Mines by Air-Photos:
- (1) Recommends careful soil handling, attention to soil types when detectability is important, and non-pattern laying to reduce detectability.
- d. Survey of Allied Tank Casualties:
- (1) Recommended use in weapon system analysis from a general point of view.
- e. Armor Study in Far East:
- (1) Recommend concentration on a medium 35-ton tank development for maximum effectiveness of armor in the Army. This includes a thorough study to compare a lighter, more economical tank (with a mechanical transmission vs a hydraulic) with the current M46 series.
 - (2) Recommend measures to tank mechanical simplification, and a review of the usefulness of stabilizers, cant correctors, and range finders.

- (3) Required: technical means for better night fighting.
- (4) Required: better equipment and training for communications.
- (5) Recommend a battalion antitank weapon, effective at 1,000 yd for the infantry; the Cobra or similar weapon indicated.
- (6) Previous recommendations for more effective mines and new methods of employment were substantiated by Korean experience.

7. Action Believed Taken by the Army on Basis of Study Results:

a. Land Mines:

- (1) The recommendation for a Research and Development program has been implemented almost to the fund level (\$5-6 millions suggested). The Air Force has given Case Institute \$300,000 to study further; and tentatively allocated \$4.85 millions to develop air-laid mines.
- (2) A mine warfare panel of 14 officers convened by Field Forces has recommended revisions in Doctrine. New tactics and training programs will evolve with the new weapons.
- (3) G-3 has reported consideration of massive use of mines in Western Europe. It is believed that the uncertainties in planning are related to when various type mines will, in fact, be available in the numbers required.

b. The Cobra:

- (1) The Army's knowledge of this study in progress has resulted in some tentative action to build some highly modified prototypes.

(2) The Under Secretary (Bendetsen) and the Comptroller have directed that ORO make further studies on the "wheels vs tracks" problem.

c. Detectability of Land Mines by Air-Photos:

(1) Attention being given in the Army to this problem.

d. Survey of Allied Tank Casualties:

(1) Being used as a source of information by various Army organizations.

e. Armor Study in Far East:

(1) The Army has speeded up its prototype evaluation of the T42 medium tank, to compare to the M46 series.

(2) Work is underway to improve night fighting capabilities and communications.

(3) The need for a cheaper antitank weapon for infantry than organic tanks has been recognized by AFF requirements for a battalion antitank weapon.

(4) The land mine research and development program implements both the "Employment of Land Mine" study and the Korean recommendations for more effective mines.

8. Publications:

ORO-T-109 Employment of Land Mines (SECRET)
 ORO-T-117 Survey of Allied Tank Casualties in World War II (SECRET)
 ORO-T-119 Analysis of a Light, Cross-Country Vehicle — The Cobra (SECRET).
 ORO-T-120 Detectability of Land Mines by Air Photo-Interpretation (SECRET)
 ORO-T-132 Employment of Land Mines In Exercise SOUTHERN PINE (SECRET)

ORO-R-1 The Employment of Armor in Korea (SECRET)
(FEC)10. Staff Members:

James W. Johnson
Emery L. Atkins
Martin Grabau

Irvin J. Breen
A. D. Cook

11. Subcontractors:

Stevens Institute of Technology
Booz, Allen and Hamilton
American Power Jet Company
Armour Research Foundation
Delta Research and Development Corporation
Emhart Manufacturing Corporation
Donald J. Belcher and Associates

12. Plans for FY53:

Project ARMOR will attempt to increase its staff during fiscal year 1952, up to ten professional staff members. Plans are to continue present work on Project ARMOR, with probable publication of the following reports.

- (1) Theoretical Investigation of the Tank vs Tank Battle;
- (2) Method of Assessing Relative Effectiveness of a Tank and Numerical Evaluations;
- (3) Technical Feasibility Study on Land Mine Fuze Development;
- (4) Mine Warfare Tactics and Strategy;
- (5) Economics of Armored Warfare;
- (6) Relative Value of Wheeled and Tracked Vehicles;

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(7) Fuel Economy of Vehicles Equipped with Hydraulic
and Mechanical Transmissions.

13. Contents of this item deleted.

1. Project Name and Number:

BALANCE (No. 99-51-11)

2. Assigned:

12 February 1951

3. Status:

Current

4. Mission:

- a. This project is directed toward conclusions concerning the optimum systems of weapons for use by selected ground force units, under varying conditions. Quantitative methods for calculating an effective balance between offensive and defensive capabilities of ground force weapons are sought. Results should take the form of a family of optimum solutions to the problem of maximizing for general effectiveness the aggregate of fire power, mobility, and protection in the tactical employment of a weapon or system of weapons. Consideration will be given throughout the analysis to the desirability of multiple purpose weapons, with particular attention to requirements for countering or neutralizing opposed enemy weapons. (Letter, ORO, dated 12 February 1951; subject: Analysis of Relations Among Weapons and Weapons Systems in Ground Warfare.)
- b. A working definition of the mission of Project **BALANCE** might be: to outline the elements and composition of a balanced Army force and weapons system.

5. Major Conclusions:

- a. **Atomic Weapons in Western Europe.** A special study, undertaken at the request of the Army Chief of Staff, G-3, offered (in ORO-T-121) certain hasty estimates of the numbers of atomic weapons required for the support of Army operations in western Europe. The estimates were submitted in mid-July 1951. Basic antecedent computations were taken from ORO-R-12(FEC), Tactical Employment of Atomic Weapons, a publication of Project ATTACK. The BALANCE inquiry bore upon the important problem of insuring that the production of fissionable material does not lag behind actual requirements. The Chief of Staff was briefed on the study, 14 August 1951.

- b. **Enemy Target Complex.** As a first step in determining the relative and absolute numbers of weapons of various characteristics desirable in the optimum weapons system, a study of the opposed target complex has been begun. The enemy has been particularized as the USSR, and the system of targets considered has been that presented in World War II, extrapolated to a modern situation by making adjustments for subsequent changes in tactical doctrine and for the probable interoccurrence of new tactical weapons. The purpose has been to arrive at findings with respect to frequency of occurrence, location, tactical importance, vulnerability, and target effectiveness and location problems, for all significant portions of the opposed target system. As of 1 June 1952, tables have been produced showing densities of troops, weapons, and equipment in the front line at last light at D minus 1 day, and at H hour minus 10 minutes, for the Soviet rifle division as now organized, equipped, and employed. Analysis thus far has been limited to the situation in which the ground forces of the USSR are attacking NATO forces along a semi-stabilized line. It is intended that this study be extended to include other military units and other tactical situations.

- c. **Battlefield Visibility and the Employment of Direct Fire Weapons.** A study now nearing completion is concerned with the limitations imposed on vision by terrain elements — natural and man-made obstructions — in the employment of direct-fire weapons. It has been found, averaging all terrain variations, that a rifleman in the prone position has a 5 percent possibility of sighting an advancing infantryman at a range of 1,000 yards; visibility is limited to 500 yards 84 percent of the time. From a study of tank-vs-tank visibility, it was found that there is a 1 percent possibility of sighting enemy tanks at 2,000 yards and that the limit of visibility is 1,000 yards, or less, 90 percent of the time. A further study, which considers the problem of visibility from forward observation points, is incomplete as of 1 June 1952.
- d. **Criteria for Infantry Hand Weapons.** A study directed toward the determination of the desirable operational characteristics of a general purpose infantry hand arm is nearing completion. Analysis of data obtained from field tests yields conclusions as follows:
- (1) The costly design precision and long-range accuracy of the M1 rifle are of doubtful value to the average infantryman.
 - (2) A marked decrease in the hit probability for all types of riflemen occurs at ranges between 100 and 300 yards. At such common battle ranges aiming errors become so large that the ballistic accuracy of the rifle is without meaning.
 - (3) Data on the incidence of gunshot wounds (as well as study of the visibility of man-size targets on the battlefield, see 5c) show that there is actually a limited requirement for delivering rifle fire at ranges exceeding 300 yards. This does not mean, however, that there is no requirement for such fire at greater ranges.

(4) Fully automatic or rapid semi-automatic fire does not increase the burst hit probability beyond that of the single (first) round.

(5) Aiming errors can be largely compensated, and hit probability at common battle ranges increased, by a design which incorporates a salvo automatic feature for the instantaneous projection of multiple missiles with a dispersion pattern fixed to maximize that hit probability. Such a weapon is tentatively believed to be technically feasible. Hit effectiveness for each aimed shot or burst would be somewhat more than doubled as compared with either single-round or fully automatic fire. It appears that such gains in effectiveness can be achieved at weapon cost and weight figures equivalent to those applying to current .30-caliber rifles and ammunition.

6. Recommendations:

- a. The special study referred to in paragraph 5a, made the explicit recommendation that the Army prepare to employ the required number, as estimated, of atomic weapons in western Europe.
- b. No other formal recommendations have yet been submitted to the Army. The other studies just enumerated are forthcoming publications and have not yet received formal distribution.

7. Action Believed Taken by the Army on Basis of Study Results:

The requirements for atomic weapons in the defense of western Europe, according to the gross estimates offered in ORO-T-121, were checked by application of the war gaming technique. The group convened by G-3 for this purpose was dependent upon ORO data; estimates did not vary materially from those of ORO-T-121. It is believed that the joint ORO-G-3 estimates were submitted by the Army to the Joint Strategic Plans Committee (Rainbow Team) of the Joint Chiefs of Staff for incorporation in an over-all Department of Defense outline of requirements.

8. Publications:

ORO-T-121 Summary Estimate of Army Requirements for
Atomic Weapons in Western Europe (TOPSECRET)

9. Staff Members:

Colonel Edward M. Parker (Ret) Chairman
Colonel Charles Billingslea Vice Chairman
Dr. John H. Gardner, (absent - with AORG, UK)
Mr. Macon Fry, (absent - with ORO, FEC)
Dr. Forrest C. Pogue
Mr. D. F. Bayly Pike (representative of AORG)
Mr. Norman A. Hitchman (absent - with ORG and CAORE, Canada)
Mr. Robert J. Best (absent - with ORO, EUCOM)
Mrs. Katherine Hafstad (administrative assignment only)
Mr. Charles F. Goepel (subprofessional)

10. Subcontractors:

- a. A subcontract in the amount of \$24,900 for the six months period ending 30 June 1952 has been let to the University of Connecticut. The subject of the investigation is physical or technical intelligence in its tactical applications. This subcontract will be extended after transfer to Project TACIT. Faculty members of the University participating in the study are:

Dr. Charles E. Waring, Director
Dr. Reinhold A. Dorwart
Mr. Carlton W. H. Erickson
Dr. Edgar Everhart
Mr. Edward V. Gant
Dr. Harold P. Knauss
Dr. John B. Lucke
Dr. William C. Orr
Mr. LaVergne E. Williams

- b. A subcontract for \$20,000, let to the American Power Jet Company was terminated on 29 February 1952. Work under

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this contract was related to the study cited in paragraph 5b. Staff members of the American Power Jet Company who participated in the work were:

George Chernowitz
Richard Gorcy
W. Joseph Carey

11. Consultants:

BALANCE, as the coordinating Project for Special Study CAVU-PATCHWORK, has indirectly employed for short periods several consultants named by Projects ARMOR, ATTACK, CAPWAR, COBRA, DONKEY, AND TREMABASE. No consultants have been employed upon any of the studies mentioned in paragraph 5.

12. Plans for FY53:

- a. The professional staff is to be increased to a total of ten persons.
- b. The following current studies will be continued:
 - (1) Analysis of the opposed target complex.
 - (2) Systematic classification of US weapons.
 - (3) Formulation of basic theory to yield analytical units of measure for tactical effectiveness.
- c. A study of the variation of the intensity of combat with the duration of that combat (which was a minor part of ORO-T-121) will be further developed upon the basis of additional data.
- d. The elaboration of a basic theory which may be applied in:
 - (1) The quantification of the structure and dynamics of combat;

- (2) The identification and analytical use of criteria of tactical effectiveness;
- (3) The determination of units of measure which will make all weapons commensurable in terms of tactical effectiveness.
- e. These studies explicitly named, as well as others, will be considered according to the philosophy which recognizes a principal — and vital — function of Project BALANCE to be the formulation of a basic theory permitting the quantitative determination of the tactical effectiveness of weapons, organization, doctrine, and training. Such theory is being developed simultaneously with the conduct of an analysis which will permit empirical verification. Such an analysis will also permit the determination not only of relative numbers of various alternative weapons and organizations, but also the absolute requirements therefor. From the last requirement, minimum essential logistic support, from communications zone distribution to design and production, may ultimately be calculated. The logic of the approach is that the targets which the enemy may be expected to present offer opportunities and set requirements to which the US (NATO) weapons array, military organization, and doctrine must be technically and operationally responsive. The logistics system, as a whole, must then produce, transport, and maintain in the field in effective contact with the enemy the indicated troops, weapons, and equipment. And finally, the intelligence system must supply in timely and adequate fashion the data for accurately engaging all remunerative targets. It has been tentatively determined that large savings may probably be effected by increasing the lethality of single rounds and by improving intelligence methods. The suggested materiel and techniques are being tested for feasibility.

13. Contents of this item deleted.

1. Project Name and Number:

CAPWAR (No. 99-51-19)

2. Assigned:

5 November 1951

3. Status:

Current

4. Mission:

To develop and to apply as required in operations research the most effective techniques for achieving the following purposes:

- a. Arriving at conclusions as to the comparative economic cost of achieving given tactical effects by use of given weapons (or weapons systems).
- b. Determining the quantities of resources saved by standardization, substitution, program cutbacks, etc.

5. Major Conclusions:

D-40 Missile is a very promising development in terms of low cost for its probable value.

6. Recommendations:

Army should support D-40 missile development.

7. Action Believed Taken by the Army on Basis of Study Results:

Indication by letter of Major General Jenkins dated 14 July 1952 that effort will be made to implement recommendation.

8. Publications:

ORO-T-189 Preliminary Report on the D-40 Missile.

9. Staff Members:

Richard U. Sherman, Chairman
Lester G. Hawkins, Vice-Chairman
Joseph F. McCloskey
Patricia W. Angelo
Walter W. Watkins
Lester E. Gordon

10. Subcontractors:

Battelle Memorial Institute
Stanford Research Institute
Booz, Allen and Hamilton

11. Consultants:

R. E. Gillmor
R. E. Johnson
Irving Siegel
Edward S. Mason
Ewald T. Grether
H. Van B. Cleveland

12. Plans for FY53:

Work plans for fiscal year 1953 are aimed at producing a number of technical memoranda in the problem areas which CAPWAR has been exploring and defining.

In general, the project will be concerned with the problem of analyzing the costs, in their many forms, of weapons and of weapons systems as well as the problem of managing the Army in terms of its readiness for immediate and future wars as this relates to costs. Despite these generalities the project has specific work under way on: (1) raw materials requirements of new

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weapons and of the whole Army weapons system; (2) scientific manpower requirements for research and development and for the operation of highly technical weapons; (3) certain aspects of the Army's cost reporting system. This work, as well as more theoretical undertakings, such as a theory of weapons life and a theory of cost for weapons involved in a cost/effectiveness comparison, will continue throughout the next fiscal year.

Preliminary studies of raw materials requirements, of manpower requirements, and of the relationship of current and budgeted expenditures to major Army combat problems, as well as the adequacy of data for the latter study, will be produced for delivery to the Army in the early part of the fiscal year.

13. Contents of this item deleted.

1. Project Name and Number:

CLEAR (No number assigned)

2. Assigned:

29 March 1951

3. Status:

Current

4. Mission:

ORO was requested to initiate a project to determine how best to utilize Negro personnel within the Army.

5. Major Conclusions:

- a. The problem of effectively utilizing Negro manpower largely stems from the low qualifications of the average Negro soldier.
- b. The Army's present policy orders assignment on a basis of individual skills, regardless of race. Preliminary evidence suggests, however, that this policy is not thoroughly understood at all command levels.
- c. The performance of Negro troops appears to improve in relation to the closeness with which they work with white troops.
- d. Utilization of Negroes in large all-Negro combat units involves unwarranted military risks.
- e. Testimony of officers in Korea indicates that integration is preferable to segregation in combat units.

- f. No racial quota is needed if personnel is accepted and assigned on the basis of qualification.
- g. No critical maximum Negro-white ratio for effective integration is now known.
- h. The problem of race, where it arises in the Army, is primarily a social problem.

6. Recommendations:

- a. All command levels should be informed that SR 600-629-1 is designed to achieve integration.
- b. Integration should be carried on gradually in existing combat and service units, except for National Guard units.
- c. The number of Negro units in the Army should not be increased in order to accommodate larger numbers of Negro selectees.
- d. No Negro unit larger than battalion size should be continued on a segregated basis.
- e. Classification by MOS should be made without reference to race; all MOSs should be immediately opened to Negroes by explicit announcement.
- f. A special study of the problem of reducing the Negro VD rate should be made.
- g. In its consideration of Negro manpower policy, the responsible Army Board or Staff Section should have the benefit of advice from eminent civilians whose judgments would be respected.

7. Actions Believed Taken by the Army on Basis of Study Results:

a. Immediately after recommendations were made to the D/A 1 July 1951, the following actions were taken:

(1) A policy of integration was announced for the entire FECOM.

(2) Integration was ordered as a gradual process through the replacement stream.

(3) The quote for assignment of Negroes in combat units was raised.

(4) All Negro units of larger than battalion size, in FECOM, were discontinued (24th Infantry).

(5) No new Negro units have been established.

8. Publications:

ORO-T-99 A Preliminary Report on Utilization of Negro Manpower. (SECRET)

ORO-R-11 (DRAFT) A Report on Utilization of Negro Manpower in the Army, Vols I, II, III. (SECRET)

9. Staff Members:

Alfred H. Hausrath
Suzanne G. Billingsley
Joseph F. McCloskey
L. Van Loan Naisawald
Florence N. Trefethen

10. Subcontractors:

International Public Opinion Research, Inc., New York, New York
Bureau of Applied Social Science Research, Columbia University,
New York, New York

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Research Center for Human Relations, New York University,
New York, New York
American Institute for Research, Inc. (AIR), University of
Pittsburgh, Pittsburgh, Pennsylvania

11. Consultants:

Robin Williams
John W. Riley, Jr.
Kingsley Davis
George P. Murdock
Roy T. Sessums
David G. Mandelbaum
John C. Flanagan
Elmo C. Wilson

Richard P. Youtz
Donald Young
Pendelton Herring
Charles Dollard
Clyde Kluckholm
Thomas Andrews
Donald Marquis
David Truman
William G. Mollenkopf

12. Plans for FY53:

According to instructions from the Army, any further work under Project CLEAR is to be pursued under Project SHOP. No new work has been requested to date.

Completion of the final report for Project CLEAR will be accomplished.

13. Contents of this item deleted.

1. Project Name and Number:

DONKEY (No. 99-49-7)

2. Assigned:

8 December 1949

3. Status:

Current

4. Mission:

To obtain a scientific analysis of the use of surface-to-surface guided missiles in the support of Army operations. Consideration will be given to technical factors involved in design and development and to military, economic, and logistic factors involved in the employment of guided missiles in possible military situations of 1955 and 1956, as contrasted with alternative means of support.

5. Major Conclusions:**a. Economics of Surface-to-Surface Guided Missiles:**

(1) The CORPORAL missile, at a production rate of 2,000 per month, requires a plant approximately one-and-one-half times the size of Willow Run. The HERMES A-3A, at a production rate of 1,000 missiles per month, requires a plant approximately twice the size of Willow Run.

(2) In critical materials, production rates of this magnitude require only a relatively small fraction of major production capabilities, with the exception of stainless steel and miniature ball bearings. The stainless steel requirement for the two missiles at the above production rates amounts to

less than 2 percent of the 1948 production; the miniature ball bearing requirements amount to approximately one-half of the present industrial capability.

(3) The complex nature of the present missile systems will require highly trained military personnel of high technical and mechanical capabilities. A critical situation is likely to arise from the fact that each of the services is increasing the requirements for highly trained individuals in practically all phases of warfare.

b. HERMES A-3A Guided Missile with HE Warhead vs.
Heavy Artillery:

(1) In a counterbattery engagement using unobserved fire, the total cost of knocking out the target weapons and crews is comparable for the HERMES A-3A guided missile and the 240-mm Howitzer for damage levels of approximately 80 percent or greater, if the missile attains its specified accuracy of 200 ft CPE. At levels of damage below 80 percent, the missile costs become considerably greater than those for the gun.

(2) In the same situation, but considering missile accuracies of 400 ft and 800 ft, the missile costs to achieve a given level of damage increase to such a degree that they are not comparable to the gun costs at any level of damage.

(3) This counterbattery study suggests that the development of a radically new weapon system such as the HERMES A-3A with HE warheads alone cannot be justified as a competitor to conventional artillery. The system must be further evaluated as an atomic or other special warhead carrier used against appropriate targets, in which case high reliability in addition to a reasonable level of accuracy would be required.

c. **HERMES A-3A Guided Missile with HE Warhead vs. Tactical Air:**

(1) In a study comparing the cost-effectiveness of the HERMES A-3A guided missile and tactical air support employing F-84F fighter-bombers, in a destruction mission using observed fire to bring the missile aim point on the target, the cost and manpower requirements for the HERMES missile system are comparable with those of the tactical air support system with the advantage somewhat in favor of the aircraft.

(2) The missile requires an accuracy of at least 200 ft CPE to be competitive with tactical air when using conventional HE warheads.

(3) For conditions of aircraft attrition above 3.5 percent, dollar costs and manpower requirements are less for the missile than for tactical air.

6. Recommendations:

- a. The methodology and data established by these studies should be utilized to extend these comparisons to the consideration of other surface-to-surface missile systems and other appropriate military situations.
- b. The scope of the present studies was limited to consideration of only the high explosive general purpose warhead. Examination of other appropriate types of warheads, conventional and atomic, should be made.

7. Action Believed Taken by the Army on Basis of Study Results:

ORO-R-1 (see the following paragraph 8a) has served as a guide for Army planning agencies on guided missile problems, including production requirements and costs, use of critical materials, military manpower requirements, and certain economic and logistic factors.

8. Publications:**a. Published:**

ORO-R-1 "Economic and Logistic Study of the Tactical Employment of Three Guided Missiles at Specified Monthly Rates." (SECRET)

b. In progress:

(1) ORO-T-118 "Preliminary Cost-Effectiveness Comparison of 240-mm Howitzer and HERMES A-3A Guided Missile in a Counterbattery Engagement." (estimated publication date June, 1952) (SECRET)

(2) ORO-T-130 "Preliminary Cost-Effectiveness Comparison of HERMES A-3A Guided Missile and Tactical Air Support with F-84F Fighter-Bombers in a Destruction Mission." (estimated completion dated July, 1952) (SECRET)

(3) "A Target Analysis Related to the Use of Surface-to-Surface Guided Missiles." (estimated completion date September, 1952)

(4) A study is nearing completion which extends ORO-T-118 see paragraph 8b(1) to a consideration of observed or corrected fire. ORO-T-118, the present study, is based on unobserved fire.

9. Staff Members:

W. G. Street
W. F. Druckenbrod
H. P. Griggs
J. T. McIntyre

10. Subcontractors:

Stanford Research Institute
Battelle Memorial Institute

**Booz, Allen and Hamilton
Columbia Research & Development Corp.
Cornell Aeronautical Laboratory**

11. Consultants:

**Consultant group under Dean Roy Sessums and Ben T. Bogard
Ruston, Louisiana**

12. Plans for FY53:

- a. A generalized study has been started at Cornell Aeronautical Laboratory which will consider the effect on the cost of a missile system of varying pay-load, range, and accuracy requirements for ballistic rocket-type guided missiles propelled by liquid or solid rocket motors.**
- b. A study which will consider the target location problems peculiar to surface-to-surface missiles with emphasis on accuracy of target location, correction, and observation of fire, and assessment of damage is under way at Columbia Research and Development Corporation.**
- c. A study comparing the cost-effectiveness of the MATADOR and REGULUS missiles in Army operations with the HERMES A-3B and the CORPORAL as atomic warhead carriers was started at Stanford Research Institute on 1 May 1952. Significant operational factors for each of the missile systems will be analyzed. At a future date, expansion of this study to include the REDSTONE missile is contemplated.**
- d. A study of the manpower and logistic problems associated with the tactical employment of the REDSTONE missile has been started by the consultant group at Ruston, Louisiana.**
- e. A comparative evaluation study of the 280-mm gun, the HONEST JOHN unguided rocket, and the CORPORAL guided missile, used as atomic warhead carriers in support of Army operations, is being negotiated with Battelle Memorial Institute.**

- f. A preliminary study of surface-to-surface guided missiles as atomic warhead carriers in support of Army operations is being prepared by the Project DONKEY staff.
 - g. A study reconciling ORO estimated guided missile production costs with current missile contractor cost estimates is under way at Booz, Allen, and Hamilton.
 - h. In view of the increased emphasis on surface-to-surface guided missiles in the Army research and development program for FY 1953, particularly as atomic warhead carriers, it becomes even more important to support Project DONKEY on a continuing basis. Several surface-to-surface missile projects which offer considerable promise as atomic support weapons for future Army operations will be passing from engineering development to service test during this period. Research studies conducted by Project DONKEY on the problems of operational use of these new support weapons will furnish valuable data to the General Staff for planning purposes and to the operating levels in the Army as an aid in establishing tactical doctrine.
13. Contents of this item deleted.

1. Project Name and Number:

DOUGHBOY (No. 99-51-13)

2. Assigned:

12 February 1951 (Personnel assigned July 1951)

3. Status:

Current

4. Mission:

The mission of Project DOUGHBOY is to analyze infantry performance with a view to determining methods of increasing the effectiveness of infantry.

a. The following factors have a direct bearing on infantry performance and, therefore, fall within the scope of the DOUGHBOY study.

(1) Selection, classification, and assignment;

(2) Training;

(3) Equipment and clothing;

(4) Physiological and psychological factors;

(5) Leadership;

(6) Communications;

(7) Organization;

- (8) Weapons and weapons employment;
- (9) Tactics;
- (10) Supply, evacuation, and maintenance;
- (11) Staff functioning;
- (12) Combat intelligence;

b. These factors are complex and closely interrelated. For purposes of initial investigation, actual combat or maneuver situations do not provide sufficient control to permit complete analysis of these variables.

5. Major Conclusions:

Brig. Gen. S. L. A. Marshall, consultant with ORO, using the after-battle interview technique, compiled a large amount of data on infantry operations in Korea during the winter of 1950-51. From these data Gen. Marshall was able to conclude that while, in general, the infantry within the Eighth US Army was as battle-worthy a foot force as we have yet produced, there is still much that can be done to further increase infantry effectiveness. Conclusions and recommendations made in this regard are too numerous and detailed to be listed in this summary. Suffice it to say that the Army has shown considerable interest in Gen. Marshall's studies (ORO-T-7 EUSAK and ORO-R-5 FEC), and that many of his recommendations have been adopted.

6. Recommendations:

See 5. above.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. A concerted effort is being made to lighten the soldier's load by eliminating non-essential items of equipment.

- b. Current Army training is being modified to better enable the infantryman to cope with the problems peculiar to combat in Korea.

8. Publications:

ORO-T-7 (EUSAK)	Notes on Infantry Tactics in Korea.(SECRET)
ORO-R-13	Analysis of Infantry Operations and Weapons Usage in Korea during the Winter.
ORO-T-185	Fatigue and Stress Symposium (RESTRICTED)
ORO-T-190	Operation Punch and the Capture of Hill 440, Suwan Korea Feb 1950. (RESTRICTED)

9. Staff Members:

Lt Col D. E. Munson, US Army
Dr. Stanley W. Davis
Mr. John R. Lamarsh
Miss Grace Donovan
Mrs. Sally Field (Part Time)

10. Subcontractors:

Technical Operations, Inc.

11. Consultants:

None

12. Plans for FY53:

a. Tactical Laboratory

With the concurrence of AFF it is proposed that a tactical laboratory be established at The Infantry School, Ft. Benning, Ga. This tactical laboratory will serve as a means for gathering data on effectiveness of weapons and small units by conducting controlled

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experiments involving troops, weapons, terrain, and equipment. Through the use of the laboratory, improved methods may be devised for evaluating and comparing the effectiveness of infantry units in order to:

- (a) Determine the relative importance of the factors previously mentioned;
- (b) Obtain information as to what degree of over-all improvement might be expected as a result if improvement in one or more of these factors;
- (c) Provide a basis for determining what constitutes improvement in those factors where change cannot be called improvement on an intuitive basis. This information would be provided to a large extent by proper use of the tactical laboratory and by the results of other studies which may be accomplished. Specifically, it is anticipated that when the tactical laboratory is established, research will be done on determining optimal organization of the infantry squad, platoon, and company; determination of the optimal balance of infantry weapons, infantry communications, particularly at the platoon and squad levels; and an initial study of fatigue and/or emotional stress relative to its importance in infantry operations.

It is expected that research will be accomplished on the use of the tactical laboratory itself to develop techniques of employing this device most effectively.

b. Fatigue and Stress

Acting on recommendations resulting from the fatigue symposium held in January 1952, Project DOUGHBOY is planning to (1) send a team of scientists to Korea to survey the fatigue stress problem as it exists in combat; (2) continue with the preparation of a literature survey of

the area of fatigue and stress; and (3) based on information obtained in tasks 1 and 2, prepare a report which would assist the Army in attacking the fatigue and stress problem. In addition, fatigue and stress will be studied in the tactical laboratory.

c. **Communications Study**

A study of communication in the infantry division is currently under way in Korea. This study will investigate the over-all problem and also examine special problems such as air-ground and infantry-armor-artillery communication. It is anticipated that conclusions will be reached and recommendations made concerning:

- (1) The need for communication equipment of new designs;
- (2) The need for reorganization or modification of the present communication system;
- (3) Measures for more efficient use of present equipment.

d. **Terrain Study**

An effort will be made to quantify terrain. Heretofore terrain has been considered in a qualitative way as to its effect upon military operations. If some method can be found to reduce the effects of terrain to a measurable quantity, this would be very useful in research and development work on weapons systems.

e. **Casualty Study**

An attempt will be made to determine if a correlation exists between a man's becoming a casualty and length of time he was with his outfit, number of times he was hospitalized, army scores of intelligence, physical

strength and marksmanship, disciplinary record, and record of awards and decorations.

f. Study on Use of Infantry Weapons and Equipment in Korea

In the final stages of completion is a study based on the results of interviewing 636 infantrymen who averaged 6-1/2 months of combat in Korea. Conclusions and recommendations will be made concerning the soldier's clothing and equipment load, the M-1 rifle, ammunition, grenades, the bayonet, BAR, LMG, 3.5 rocket launcher, 57- and 75-mm recoilless rifles, amount of basic training given in use of weapons, and effectiveness of enemy weapons.

For the fiscal year of 1954 DOUGHBOY plans for:

1. Continued experimentation with the tactical laboratory since it is anticipated that techniques for its use will be established by that time.
2. Verification of some of the results of the tactical laboratory in maneuver and/or combat situations.
3. Specific operational research in areas that do not lend themselves to analysis in the tactical laboratory.

13. Contents of this item deleted.

1. Project Name and Number:

ENVANAL (99-48-2)

2. Assigned:

August 1948

3. Status:

Completed 12 July 1950

4. Mission:

- a. To provide a means of rapid analysis of the performance of standard Army equipment under certain individual Arctic environmental conditions.
- b. To determine the validity of using such analyses as the bases for estimates of the Army's technical capability in any region characterized by similar specific conditions.
- c. To determine the feasibility of making such analyses and of obtaining such estimates by business machine methods.
- d. To devise procedures, if machine methods prove feasible, for extending these analyses and estimates of the Army's technical capability on a global basis.

5. Major Conclusions:

The ENVANAL system as described in ORO-R-4, using the machine methods outlined in that report, is both economical and valid as a tool for Department of the Army planning.

6. Recommendations:

- a. Project ENVANAL study should be implemented and support given the Technical Services for its rapid completion.

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- b. The Army should undertake additional research in the development of military characteristics and specifications.

7. Action Believed Taken by the Army on Basis of Study Results:

Action recommended by RDB, with a recommended fund of \$100,000 in their fiscal '51 budget. Action by the Army is still pending.

8. Publications:

ORO-T-36 Temperature Performance Efficiency of Army Equipment (SECRET)

ORO-R-4 Analysis of Performance of Army Equipment Under All Environmental Conditions (RESTRICTED)

9. Staff Members:

Mr. Emery L. Atkins
Mr. P. B. Mansfield

10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY 53:

None

13. Contents of this item deleted.

13. Contents of this item deleted.

1. Project Name and Number:

GUNFIRE (No. 99-49-5)

2. Assigned:

23 November 1948

3. Status:

Project terminating.

4. Mission:

To determine the nature and extent of existing deficiencies in equipment, techniques, computational procedures, organization, training, and doctrine adversely affecting the accuracy of predicted fires; and to outline a program designed to correct the deficiencies revealed by the over-all evaluation.

5. Major Conclusions:

- a. Predicted artillery fire is estimated to constitute less than seven percent of total artillery fire.
- b. Variations of the atmosphere and mistakes or gross errors of personnel are the two most important contributors to inaccuracy of predicted artillery fire.
- c. Time variations of the atmosphere result in such large errors in the meteorological corrections that the probable error in MPI of predicted artillery fire is very large.
- d. Radar tracking of artillery shells will reduce the probable error of the MPI of predicted artillery fire by a substantial percentage.

6. Recommendations:

- a. A method of carrying out predicted artillery fire which obviates the necessity for meteorological corrections should be developed.
- b. Artillery training methods should be revised to provide for better detection and elimination of mistakes.
- c. Operational steps involved in predicted artillery fire should be modified to reduce the possibility for occurrence of gross personnel errors.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. The Artillery School has begun a study of the occurrence of mistakes made by artillery personnel.
- b. The Signal Corps (Evans Signal Laboratories) has let a contract to New York University to study atmospheric variability.
- c. The Signal Corps is using information in the shell-tracking report by Snow and Schule, Inc., in the development of the AN/TPQ-5, a Field Artillery radar.

8. Publications:

- ORO-T-62 Sound Ranging for the Field Artillery, by The Franklin Institute Laboratories (SECRET) .
- ORO-T-68 The Incidence of Predicted Field Artillery Fire, by Dorothy K. Clark (CONFIDENTIAL).
- ORO-T-75 The Evaluation of Weapons: With Special Reference to the Value of Artillery, by Kenneth W. Yarnold and Jean M. Daly (CONFIDENTIAL)
- ORO-T-142 Analysis of Systems for Tracking or Spotting Friendly Field Artillery Shells under Predicted Fire Conditions, by Snow and Schule, Inc. (SECRET).

ORO-T-144 The Effects of Errors in Meteorological Corrections on the Accuracy of Predicted Artillery Fire, by Katharine C. Hafstad (SECRET).

9. Staff Members:

Wayne E. McKibben - Resigned Sept. 1951.
Katharine C. Hafstad - Transferred to another project.
W. L. Whitson - Acting Project Chairman.

10. Subcontractors:

The Franklin Institute Laboratories for Research and Development. Contract Terminated.
Snow and Schule, Inc. Contract Terminated.
Dunlap and Associates, Inc. Contract Terminated.

11. Consultants:

Wayne E. McKibben
Kenneth L. Yudowitch

12. Plans for FY 53:

A final report will be written and this project closed out in favor of the more general artillery project REDLEG.

13. Contents of this item deleted.

1. Project Name and Number:

LEGATE (No. 99-51-14)

2. Assigned:

14 December 1950

3. Status:

Current

4. Mission:

"This project is directed toward conclusions concerning the conduct of military government in occupied areas. All probable areas of occupation by the US Army are to be considered."

5. Major Conclusions:

a. Based on study of Army experience in Korea, 1950-51:

(1) Military and political components in modern warfare are inseparable.

(2) Responsibility for substantial CA/MG (Civil Affairs and Military Government) functions devolves upon the Army wherever it fights and furnishes the major logistical support.

(3) Policy direction has tended to lag behind events, thereby handicapping field commanders.

(4) The lack of a formal civil affairs agreement with the Republic of Korea was found to be a source of friction between civil affairs personnel and Korean officials.

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(5) There has been no clear locus of responsibility for civil affairs in Korea, either within the Army organization or as between the Army and other US and UN agencies.

(6) The lack of reliable information regarding the operation of the Korean economy has handicapped the programming of aid.

(7) The quality of military personnel assigned to civil affairs in Korea has not been commensurate with the importance of the function.

(8) The lack of US personnel trained in the Korean language has placed the Army at a serious disadvantage in its efforts to "advise" indigenous officials.

6. Recommendations:

a. Concerning the Conduct of Future Civil Affairs Operations.

(1) Wherever the Army conducts operations within the territory of a nation treated as sovereign for political reasons, a Civil Affairs Agreement should be negotiated during the early stages of the conflict, making provision for such controls over the internal affairs of the area as are deemed necessary.

(2) The organization for civil affairs should provide for:

- (a) A single focus of responsibility for all CA/MG functions;
- (b) A single point of contact within the Army for relationships with the indigenous government;
and
- (c) A status for the civil affairs units, at both staff and operating levels, that is commensurate with the importance of their tasks.

(3) The Army should take steps to impress commanders and line officers with the importance of CA/MG and to find qualified officers and teach them the substance of CA/MG.

b. **Civil Affairs and Military Government in Korea.**
Studies should be made of:

(1) Those aspects of the operation of the Korean economy that have affected the administration of the Army economic aid program and the evaluation of the economic data that are required to enable the Army to formulate ~~an~~ effective economic management measures.

(2) All agreements and attempts to negotiate agreements with the Republic of Korea on civil affairs matters, for the purpose of determining the effects that these agreements or the lack of agreements have had on civil affairs operations.

7. Actions Believed Taken by the Army on Basis of Study Results:

None known.

8. Publications:

a. **Published:**

ORO-T-136 Research in Occupation Administration
(RESTRICTED)

b. **In Progress:**

ORO-T-184 Civil Affairs in Korea (SECRET)

9. Staff Members:

C. Darwin Stolzenbach—Project Chairman
Roswell B. Wing
Milton J. Esman
Robert C. Sorensen

10. Subcontractors:

Governmental Affairs Institute, 1785 Massachusetts Ave., N. W.,
Washington 6, D. C.

11. Consultants:

David B. Truman
George P. Murdock
Carlton A. Wood

Henry A. Kissinger
John D. Montgomery

12. Plans for FY53:

Plans for FY53 are being shaped largely in the light of advice from the Army Advisory Group for Project LEGATE, which can be summarized as follows:

- a. Study functional rather than geographical area problems;
- b. Give initial priority to the following functional problems: economic and financial; utilization of civil government; and means of dealing with politically undesirable elements.
- c. Second priority to: civil information and education; displaced populations; and reform of institutions.
- d. Specifically to study the top-priority functional problems in a minimum of three countries such as Germany, USSR (German occupation), and Korea.

Studies now in progress, to be continued in FY53, include:

- a. Studies in Germany on US occupation problems and on problems of German occupation of the USSR, with major attention directed to priority functional areas;
- b. Studies in Japan of US occupation, particularly the treatment of politically undesirable elements;

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- c. Studies of civil affairs problems in Korea, especially economic aid and need for formal agreements.
 - d. Utilization of indigenous authorities to support military operations.
13. Contents of this item deleted.

1. Project Name and Number:

OPSEARCH (No. 99-51-17)

2. Assigned:

12 February 1951

3. Status:

Current

4. Mission:

The project is directed toward the findings related to the progressive development of method in operations research; progressive organization of existing doctrine on scope, methods, and administration of operations research; and analysis of the feasibility of quantitative research on problems to which such analysis has not been previously applied. The projects will include, but will not be necessarily confined to:

- a. Analysis of problem solving;
- b. Design of tentative methods of problem solution;
- c. Design of tentative methods for quantification of formerly unquantified problems;
- d. Analysis of methods of testing tentative method of problem solution;
- e. Analysis of methods of validating results;
- f. Analysis of administration and organization of operations research for the Army;

g. Studies of the methods of recording and reporting combat operations as required for further scientific operations analysis in conjunction with other projects on combat operations.

5. Major Conclusions:

None

6. Recommendations:

None

7. Action Believed Taken by the Army on Basis of Study Results:

None

8. Publications:

None

9. Staff Members:

Mr. Scott E. Forbush
Mr. M. L. Norden
Mr. George Blakemore

10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY53:

Studies leading toward evaluating this effectiveness of weapons systems on a statistical basis are to be continued. Methods will

be investigated for evaluating the effectiveness of the weapons system. Attempts will be continued to find mathematical methods for Army combat operations in order to determine what factors might be altered to improve the yield of operations.

Four years experience at ORO has demonstrated the necessity for a computing laboratory. Delivery of basic IBM units, using punched cards, was delayed but is expected to be effected soon. Experience to be gained from use of the IBM equipment, together with a further analysis of the tupes of problems expected to arise in operations research for the Army, will determine the extent to which it is necessary to expand the facilities of the computing laboratory by the addition of electronic and analogue computers.

13. Contents of this item deleted.

1. Project Name and Number:

PARABEL (No. 99-51-55)

2. Assigned:

12 February 1951

3. Status:

Current

4. Mission:

To find conclusions concerning the potential effect of irregular and partisan warfare, methods of initiating, supporting, and preventing such warfare, and the most probable areas of use against an enemy power or against the US and its allies.

The importance of para-military warfare is amply borne out by historical precedent, and especially the past precedent of World War II, and is currently well attested by two pertinent facts and by two prognostications.

(1) Resistance movements are active and techniques of guerrilla warfare are employed now in several areas, notably Indo-China, Malaya, China, and the Philippines. These activities are phenomenally efficient: in one area up to fifty organized troops are engaged for each single guerrilla fighter.

(2) Guerrilla warfare may start before D-day and continue long after V-day in any war.

(3) In the near future, guerrilla activity is likely to be sponsored by the USSR in fringe areas in order to pin down Allied troops and attenuate Allied military strength.

(4) Tactical employment of atomic weapons may tend to make stabilized fronts and heavy troop concentrations militarily impracticable. Extended fields of battle of a war of movement will create "empty spaces" and extended lines of communication vulnerable to infiltration and sabotage by irregular forces equipped with the latest technological equipment. Thus, ground warfare may increasingly resemble guerrilla operations.

A great deal has been written about guerrilla warfare but little has been done to develop a systematic treatment of the factors affecting strategy, tactics, capabilities, vulnerabilities, and training. In a systematic treatment of this subject, terms must first be defined, useful concepts developed, and a theoretical structure established. The terms, concepts, and theories must be abstracted and synthesized from historical evidence, then tested and applied both to past and to specially collected recent data, e. g., results of interrogation, direct observation of guerrilla warfare, and so forth.

5. Major Conclusions:

None

6. Recommendations:

None

7. Action Believed Taken by the Army on Basis of Study Results:

None

8. Publications:

None

9. Staff Members:

Mr. Fred H. Barton, Sociologist
Mr. Theodore Bullockus, Geopolitician
Mr. C. F. Latour, Political Scientist

Mr. Philip R. Lever, Economist
Mr. Allen N. Saltzman, Philosopher
Miss Ruth Upson, Historian

10. Subcontractors:

Hoover Library, Stanford University

11. Consultants:

Dr. William Cornyn, Professor of Asiatic Languages,
Yale University

Dr. E. B. Espenshade, Professor of Geography, North-
western University

Dr. Melvin Kranzberg, Professor of History, Amherst College

Dr. Arnold J. Kuhn, Sociologist, Chicago

Dr. Marcel Vigneras, Historian, Office of Military History

12. Plans for FY53:

Three major phases and two minor ones are planned for Project PARABEL:

- a. An historical survey. Primary sources are being abstracted for up to twenty different guerrilla and partisan campaigns of the past, primarily those during the World War II years including Greece, Italy, Palestine, the Philippines, and China, by the Hoover Library from their holdings, and France, Yugoslavia, and Russia by the staff from sources in Washington. Data is being recorded on file cards, each referring to a specific class of information such as supply, motivation, organization, type of mission, terrain, tactics, countermeasures, achievements, etc. Altogether, over 90 such classes of information are under study. From the collected data it is intended to compare and contrast achievements under various conditions, to detect patterns of strategy and tactics, and to evaluate "rules-of-thumb" proposed by experts with limited experience. As far as possible, all recommendations arising in Project PARABEL will be checked against this body of historical facts.

- b. Vulnerability to guerrilla and partisan attack. Quantitative estimates are being made of the effort required to achieve damage or interdiction, of the effort required to repair damage, and of the military effect of damage and interdiction by guerrilla or partisan forces. A subcontract is being negotiated with the Stanford Research Institute to employ engineers on this study. It is expected to draw attention to the most profitable targets for attack, the need for new devices in guerrilla and partisan warfare, and improvements in defense against such attack.
- c. Organization of guerrilla and partisan units. The complex human relations involved have never been analyzed in a broad study. No progress to date.
- d. The costs and effectiveness of guerrilla warfare. An effort is being made to assess the cost of guerrilla attack to compare it, for instance, with the cost of air bombardment of targets far beyond the front line. In many instances it may be far cheaper and more expedient to destroy a bridge, say, by guerrilla attack rather than by bombs.
- e. The legal aspects of guerrilla warfare. A summary is being prepared of various national laws and recognized parts of international law which bear on the treatment of captured guerrillas and the responsibility for guerrilla action.

13. Contents of this item deleted.

1. Project Name and Number:

POWOW (No. 99-49-6)

2. Assigned:

26 February 1949

3. Status:

Current

4. Mission:

The mission of this project is to determine, by scientific analysis and synthesis, the maximally effective weapons, instruments, and techniques that may be employed by ground forces in the conduct of psychological warfare operations. Synthesis must necessarily be in terms of the optimal Army organization to include tactical units. Logistical factors, facilities, intelligence, and the selection and training of specialized personnel will be considered as elements of the problem with emphasis on requirements to insure technical superiority for the accomplishment of tactical missions in combat.

5. Major Conclusions:

a. General Comment:

(1) Army organization for psychological warfare has been, throughout the history of the project, in a state of flux; research on psychological warfare, is still not wholly out of an initial phase of uncertainty; existing scientific knowledge bearing upon psychological warfare remains inadequately organized. For these reasons, operations research on psychological warfare at first assumed a character markedly

different from operations research in other fields. The war in Korea has, however, afforded an opportunity for intensifying and focussing certain aspects of the research, which for reasons both of geography and administrative necessity have been treated as virtually a separate project, without immediate relation to the research operations going forward in Washington. Many of the concrete conclusions and recommendations on psywar put forward by ORO belong to that project, and the most definite actions taken by the Army on the basis of ORO advice have resulted from it. (See FEC No. 4.)

b. Specific Conclusions:

- (1) Psywar conducted by strategic means has little precise tactical effect.
- (2) American military psychological warfare has not been clear in doctrine as to functions, potentialities, requirements of personnel, requirements for supporting research, or necessary relationships with intelligence and operations.
- (3) Existing schemes of classification of materials bearing on psywar are unsatisfactory.
- (4) Present equipment for air-borne loudspeaker operations is unsatisfactory and reflects obsolete conceptions concerning tactical factors.
- (5) The programming of the Soviet radio follows a definite pattern peculiar to itself which can be reduced to simple formulation and this pattern should be taken into account in future psywar planning.
- (6) A roster of qualified and experienced personnel would be of great value to psywar planning and operations.
- (7) Successful psywar operations require soundly developed manuals of information on the target audience or area.

- (8) The tactical potentialities of psywar have been inadequately exploited in the past and merit careful attention from psywar planners and researchers.
- (9) Nazi psywar in Russia offers lessons on what to avoid.
- (10) The Nazis had a systematic theory and a methodology of propaganda which, because of their marked success in the years from 1924 to 1940, in many situations deserve close examination.
- (11) Indoctrination of psywar personnel requires a clear, analytic doctrine of psywar operations.
- (12) The surrender of prisoners is a crude and only partially valid measure of the effectiveness of a psywar effort.

6. Recommendations:

The Army should establish a roster of qualified and experienced psywar personnel.

The Korean War affords a laboratory of operational experience in which every opportunity should be seized for operations research on psywar.

Psychological warfare planners should take steps to establish a program for the preparation of sound area manuals.

Psychological warfare planners should take steps to establish a program for preparing of sound manuals on psywar operations.

The planners of US psychological warfare should reconsider the ideas on propaganda method developed by Hitler and Goebbels with a view to seeing how their insights on some matters of technique might further future US psychological warfare operations.

The Army should re-examine the whole question of air-borne loudspeakers in the light of tactical considerations and with a view to future development research in this field.

Research requirements for support of psychological warfare operations include considerable areas for which the Army should provide research facilities outside of ORO.

7. Action Believed Taken by the Army on Basis of Study Results:

Some use has been made of a preliminary roster of experienced psywar personnel prepared under ORO auspices.

Army decisions on a program for preparing of training and reference manuals has reflected continuous discussion between OCPW and ORO.

ORO studies, among other factors, have influenced the Army to expand and systematize its established organization for psychological warfare.

The Army has supported intensive efforts by ORO to reap the benefits of experience in the Korean War.

The Army has established HUMRRO to provide other research support for psywar, in addition to operations research.

(For other Army actions based on ORO study results see separate data on ORO work on psywar in the Far East Theater.)

8. Publications:

- ORO-T-2 Lessons on Morale to Be Drawn from Effects of Strategic Bombing on Germany: With Special Reference to Psychological Warfare (UNCLASSIFIED)
- ORO-T-7 Psychological Warfare - a Strategic or a Tactical Weapon (RESTRICTED)
- ORO-T-11 German Psychological Warfare Against Russia (SECRET)
- ORO-T-20 The Choice of an Optimum Audience for Propaganda Campaigns (RESTRICTED)
- ORO-T-37 Psychological Warfare Requirements of a Combat Division (RESTRICTED)

- ORO-T-44 **Aircasting (CONFIDENTIAL)**
- ORO-T-76 **Abstract of "Questionnaire for Research into the History of the War Dealing with the Mutual Relationship between Operational and Psychological Warfare," by General of Infantry Guenther Blumentritt (RESTRICTED)**
- ORO-T-78 **The Classification of Psychological Warfare Subject Matter (CONFIDENTIAL)**
- ORO-T-79 **The Programming Pattern of the Soviet Domestic Radio (CONFIDENTIAL)**
- ORO-T-82 **The Value of Propaganda Leaflets Disseminated by Aircraft (CONFIDENTIAL)**
- ORO-T-85 **Frontiers in Psychological Warfare (CONFIDENTIAL)**
- ORO-T-89 **The Military Value of Propaganda Shell, Pts. I and II (CONFIDENTIAL)**
- ORO-T-105 **The Military Value of Propaganda Disseminated by Loudspeaker (CONFIDENTIAL)**
- ORO-T-116 **A Proposed Handbook of Regional Intelligence for Psychological Warfare (RESTRICTED)**
- ORO-T-135 **Commentary on Hitler's Theories of Propaganda (RESTRICTED)**
- ORO-T-141 **Planning for Psychological Warfare (RESTRICTED)**
- ORO-T-171 **Soviet Printed Media -- Instructions (RESTRICTED)**
- ORO-T-172 **Soviet Printed Media -- Layout (RESTRICTED)**
- ORO-T-173 **Soviet Printed Media -- Type Faces (RESTRICTED)**

ORO-T-174 Soviet Printed Media – Dictionary (RESTRICTED)

ORO-T-181 A Memorandum on Terror and Panic Focussing
upon Inducement and Reinforcement
(CONFIDENTIAL)

(See also publications listed under ORO work on psywar in the
Far East Theater).

9. Staff Members:

Willmoore Kendall, Chairman
Lessing A. Kahn, Vice-Chairman

David E. Ambrose
William E. Daugherty
Gerard Hinrichs
Joanne Jackson
Maurice J. Mountain
Florence K. Nierman
Peter K. Ogloblin
John Ponturo
Julius Segal

David J. Carpenter
Leo Teholiz
William R. Young
Lawrence F. O'Donnell

} Terminated

10. Subcontractors:

Yale University
Oklahoma A. & M. College
International Public Opinion Research
American Institute for Research
American University

11. Consultants:

H. Abelson
T. G. Andrews
A. De Grazia
R. C. Hackman
M. Janowitz
E. T. Kemler

P. M. A. Linebarger
S. W. Marshall
E. W. Marvick
R. C. Morley
L. Nemzer
M. G. Preston
W. Schramm
Denzel D. Smith
T. R. Vallance
I. Wayne

12. Plans for FY53:

During the past year certain studies were begun in categories which are to be continued by the Human Resources Research Office. The relative overexpansion of Project POWOW occasioned by this work will be succeeded by a corresponding shrinkage when, during FY53, studies of these types are transferred to the Human Resources Research Office.

In general, plans for FY53 call for a more intensive effort on tactical psywar in the Korean war. Specific major tasks, grouped according to their stage of development, are provided for as follows:

- I. Studies to be completed upon which substantial progress has already been made:
 - a. A basic text for psychological warfare operators and trainees in three volumes:
 - (1) Theory and Nature of Psywar
 - (2) Nature and Use of Psywar Media
 - (3) Cases and Problems in Psywar
 - b. Two area manuals, one dealing with China and the other with Czechoslovakia, designed to give the psywar operator what he needs in the way of cultural-psychological information about a target audience.

- c. An analysis and grouping of sample leaflets to develop classification schemes.
- d. A study, in two phases, of the psychological effects of weapons in the Korean War. Phase I covers the effects of UN weapons on enemy troops; Phase II covers the effects of enemy weapons on UN troops.
- e. A study of the attitudes of North Korean and Chinese Communist prisoners of war toward communism, American democracy, and the United Nations.
- f. A study of the morale and military optimism of North Korean and Chinese Communist forces through an analysis of the attitudes of North Korean and Chinese Communist prisoners of war toward the outcome of the Korean War.
- g. Final stage of an analysis begun and reported on in ORO-T-2 (EUSAK) under the title: "A Preliminary Study of North Korean and Chinese Surrenders."
- h. An investigation of individual factors relating to the effectiveness of psywar.
- i. A study of pretesting procedures for psywar printed media. Phase II: Ranking and Other Methods.
- j. A study of present methods used by the Army to distribute propaganda leaflets against tactical targets.

II. Studies to be initiated immediately:

- a. A study of front-line psywar operations with a view to describing, analyzing and evaluating psywar's integration into standard military operations.
- b. A study of the critical requirements for certain categories of psywar operating personnel.

- c. A study to determine a family of weapons for leaflet distribution and voice-casting, both ground and airborne.
- d. A study of the normal system of mass communication in certain probable target areas with a view to enabling psywar operators to exploit domestic propaganda media and devices peculiar to such target areas.

III. Studies under consideration for possible inclusion in FY53 program:

- a. The development of procedures for writing of psywar materials in military language and idiom.
- b. An evaluation of psychological warfare influence on North Korean and Chinese Communist forces in Korea for periods not already studied. This evaluation to be continuous and published periodically as required.
- c. An analysis of the effectiveness of the United Nations psychological warfare organizational structure for periods not already studied.
- d. An evaluation of psychological warfare influence on the North Korean civil populace, to be continuous and published periodically as required.
- e. Analysis of Chinese Communist and North Korean methods of training, indoctrinating and controlling Chinese and North Korean soldiers with particular emphasis on means of developing and maintaining the soldier's will to fight.

13. Contents of this item deleted.

1. Project Name and Number:

REDLEG (No. 99-51-16)

2. Assigned:

12 February 1951

3. Status:

Current

4. Mission:

This project is directed toward conclusions concerning the employment of field artillery in the support of ground operations based on the military, logistic, and economic factors involved in such employment in possible situations of 1952, 1955 and 1960. Artillery will be compared with alternative means of support.

5. Major Conclusions:

Command Post Exercise conducted at Exercise SOUTHERN PINE indicates that TAS doctrine and procedure for the new 280-mm gun are adequate.

6. Recommendations:

None

7. Action Believed Taken by the Army on Basis of Study Results:

None

8. Publications:

ORO-T-129 Atomic Play at Exercise SOUTHERN PINE
Sept. 1951. Sections on Atomic Artillery.
(SECRET)

9. Staff Members:

L. D. Yates, Acting Chairman
J. C. Bernens (Assigned to ORO-FEC)

10. Subcontractors:

Negotiations with Battelle Memorial Institute (Mr. R. J. Lund)
Subject — Development of a System for Recording Data Required
for Artillery and Tactical Bombing Effectiveness Studies.

11. Consultants:

Dr. K. L. Yudowitch

12. Plans for FY53:

- a. Studies in Korea on current artillery and mortar problems will be conducted.
- b. A data system utilizing IBM techniques will be developed to record artillery and tactical bombing information required for pertinent weapons effectiveness studies.
- c. Carrying out the following investigations is contingent upon availability of research personnel in the project:
 - (1) Effectiveness/cost ratio for various guns and mortars;
 - (2) Effectiveness of various types of ammunition, fuzing, and methods of laying on fire;
 - (3) The counter battery problem in relation to probable USSR artillery opposed;

- (4) Self-propelled vs. trailed guns and wheels vs. tracks ;
- (5) Coordination of supporting fires from artillery, armor, and atomic weapons;
- (6) Artillery command and communications problems in relation to various schemes and maneuver.

13. Contents of this item deleted.

1. Project Name and Number:

SHOP (No. 99-51-20)

2. Assigned:

28 November 1951

3. Status:

Current

4. Mission:

The Mission of this project is to study, through operations research, human factors which affect the capabilities of individuals and groups to perform military tasks, particularly in combat.

It is axiomatic that all military operations are ultimately dependent on the behavior of men. Analysis of factors bearing on the effective utilization of our human resources is recognized as necessary to provide balanced studies of military problems which properly reflect the human as well as the material aspects involved.

This project will provide for operations research, when desirable and feasible, on Army problems in the utilization of manpower including selection, classification, assignment, training, organization, development and maintenance of morale and motivation, leadership, combat effectiveness, human engineering and psychophysiology.

The selection of specific research targets will be based upon consideration of:

- a. Human factors related to the operational and weapons problems assigned to ORO for study.

- b. Analysis of particular problems concerning human factors in military operations assigned to ORO for study as the research need arises.
- c. Advice to ORO by the Advisory Committee on Project SHOP and by the Army Advisory Committee on ORO.
- d. The ORO program of research on human factors in military operations will be coordinated with the programs of Army agencies charged with the developmental research in the human resources field and information on programs, data collected, and suggestions for the direction of the research effort will be exchanged through the proper channels.

5. Major Conclusions:

Three types of studies have been carried forward to some stage of completion. Each of these is summarized below:

- a. Military manpower studies have been made for the United States, East and West Germany, Hungary, Turkey, India, and Pakistan. These surveys indicate the number of men of military age for 1950, 1955, and 1960. Estimates are made of the number of men each country could put into the field as troops for each of these years.
- b. A study of the performance and psychological reactions of troops participating in an atomic maneuver, Exercise DESERT ROCK I, was completed. The general conclusions were:
 - (1) The men performed adequately and gave no outward signs of fright.
 - (2) Physiological evidence showed there was significant tension.
 - (3) Performance, when A-Bomb is used, of typical troops in combat cannot be predicted from this maneuver.

c. **Utilization of Negro Manpower in the Army.** Although this Project was begun as a special study, it has been absorbed in Project SHOP. Studies were made in the combat zone in Korea and in the Zone of the Interior. Conclusions from this study were:

(1) Integration increases the effectiveness of Negro troops without materially lowering the effectiveness of white troops with which they are integrated.

(2) Integration avoids concentration of low aptitude soldiers.

(3) Integration up to 15 to 20 percent Negro was studied and found feasible.

(4) General public sentiment seems to be ready for integration in the Army.

6. Recommendations:

So far Project SHOP has conducted special studies centering upon human problems. The need now is for a long range plan to provide a core of studies which will contribute to improve effectiveness of the Army, particularly in combat. Some studies are underway and several have been proposed which would contribute to this objective. These studies should center upon combat performance, motivation, morale and leadership, training and utilization of manpower. It is recommended that they be considered by the Advisory Group and undertaken as a coordinated series.

7. Action Believed Taken by the Army on Basis of Study Results:

a. Several recommendations of Project CLEAR have been carried out in FECOM, EUCOM, and several other commands, including many units in the ZI.

b. The study initiated at DESERT ROCK I is being continued at DESERT ROCK IV, along the lines recommended.

8. Publications:

- ORO-T-99 A Preliminary Report on Utilization of Negro Manpower. Volumes I, II and III. (SECRET)
- ORO-R-11 Utilization of Negro Manpower in the Army. Volumes I, II and III. (SECRET)
- ORO-T-170 Troop Performance on a Training Maneuver Involving the Use of Atomic Weapons. (SECRET)
- ORO-T-179 Western and Eastern Germany Military Manpower Potential. (CONFIDENTIAL)

9. Staff Members:

A. H. Hausrath	N. R. Kidder
Suzanne G. Billingsley	Florence N. Trefethen
L. V. Naisawald	Harry V. Webb (temp.)

10. Subcontractors:

American Institute for Research
 Bureau of Applied Social Research (Columbia U.)
 International Public Opinion Research, Inc. (work complete)
 Russell Chatham, Inc.
 Bureau of Social Science Research (American U. for possible contract work)

University of Oklahoma
 Oklahoma A&M College (for possible contract work)

11. Consultants:

Robin Williams	Richard P. Youtz
John W. Riley, Jr.	Donald Young
Kingsley Davis	Pendelton Herring
George P. Murdock	Charles Dollard
Roy T. Sessums	Clyde Kluckholm
David G. Mandelbaum	Thomas Andrews
John C. Flanagan	Donald Marquis
Elmo C. Wilson	David Truman
	William G. Mollenkopf

12. Plans for FY53:

- a. Increase Staff to 11 or 12 technical personnel.
- b. Complete research projects underway and undertake new studies, subject to approval by the Department of the Army.
 - (1) Continuation of Combat Performance Studies.
 - (2) Completion of DESERT ROCK IV Studies.
 - (3) Completion of Organization of the Infantry Division Study.
 - (4) Undertake study of indigenous manpower.
 - (5) Undertake a study of methods of training CCF, NK, ROK, and UN troops in Korea.
 - (6) Completion of military manpower potential of possible enemy and ally countries.
 - (7) Exploration of physiological measures as possible indicators of combat performance.
 - (8) Army requirements and supply of personnel with specialized knowledge of
 - (a) Languages — communication
 - (b) Foreign cultures — people and customs
 - (c) Foreign areas — physical features and resources.
 - (9) The utilization of officers for combat duty in Korea.
 - (10) The evaluation of officer training centers (ROTC, OCS, etc.)
 - (11) Survey of selected background literature on the utilization of womanpower in the Army.
 - (12) Records management of Army units in the field.

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13. Contents of this item deleted.

1. Project Name and Number:

TACIT (No. 99-52-1)

2. Assigned:

16 February 1952

3. Status:

Active

4. Mission:

- a. The purpose of this project is to determine how Army combat intelligence activities may be improved, with particular emphasis on the development of devices, techniques, and methods which will insure the timely and adequate production of the intelligence required by combat commanders in connection with the tactical use of atomic weapons.
- b. Priority in the study and research of this project will be given to:
 - (1) Development of methods and equipments which will more accurately and rapidly locate and identify significant enemy forces, and evaluate potential tactical targets in terms of their suitability for atomic attack.
 - (2) Development of methods and equipments for communication of intelligence information and intelligence which will be less subject to mechanical failure, interruption by enemy action, and interception or location by hostile forces.

(3) Development of methods and equipments for more effective use of aerial photo reconnaissance as an information collection method.

- c. After significant progress has been made in the mission outlined above, its scope may be extended by mutual agreement of ORO and the Assistant Chief of Staff, G-2, Intelligence, to include other aspects of the intelligence system which may be improved as the result of operational research study and analysis.
- d. Intelligence activities falling within the area of responsibility of the Army Security Agency are excluded from the foregoing missions.

5. Major Conclusions:

None

6. Recommendations:

None

7. Action Believed Taken by the Army on Basis of Study Results:

None

8. Publications:

None

8. Staff Members:

Dr. Michael Leyzorek, Psychologist
Mr. Joseph W. Hazell, Psychologist

10. Subcontractors:

None

11. Consultants:

John Atanasoff
Walter S. Baird
Donald J. Belcher
Bruce Billings
Earl K. Bowen
Ken M. Davee
Howard T. Engstrom

Louis W. Erath
Edward B. Espenshade, Jr.
Edward S. Gilfillan, Jr.
Samuel A. Goudsmit
Willard Machle
Ernest C. Pollard
A. E. Whitford

12. Plans for FY53:

In order to carry out the mission of Project TACIT it is estimated that a team of at least six technical personnel is necessary. It is planned to engage at least one communications engineer, one physicist, and one mathematician as soon as possible.

The over-all problem is being considered in four phases, with the following tentative plans for each phase:

- a. The collection of combat intelligence information. A survey is under way of all present means of collection, and of all possible physical detectors. Part of this work is being done under a subcontract (No. FY52-266-21 with the University of Connecticut), originally negotiated under ORO Project BALANCE, which will be transferred to Project TACIT on 1 July 1952. It is expected that this survey will point up new detection devices worth further study and development.

Of particular interest are devices for the rapid detection of large targets worthy of an atomic bomb. One such is seismic detection of moving vehicles and marching troops. For this study subcontracts are being negotiated with Ordnance Engineering Corp. of Bethesda, Maryland, and Southwest Industrial Electronics Company of Houston, Texas. Another study is the statistical combination of data from aerial reconnaissance and photography to locate concentrations of troops and vehicles by observed movement along road and rail nets, for which a subcontract may be negotiated with Donald Belcher Associates.

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- b. The transmission and processing of combat intelligence information. Data are being collected by the staff at maneuvers and in Korea relative to present communications channels, the flow of information through these channels, and bottlenecks in such flow. Applications of the mathematical theory of information—and of work in group dynamics—will be developed.
 - c. The presentation of evaluated combat intelligence. It appears that this phase will involve a study of the requirements for intelligence and its use by commanding officers. Consideration will be given to presentation devices as developed by the Navy for its Combat Intelligence Centers as well as the type of intelligence, requirements for timeliness degree of integration, etc.
 - d. The training of intelligence personnel (and the intelligence indoctrination of all Army personnel.) No progress to date.
13. Contents of this item deleted.

1. Project Name and Number:

TEAR (No. 99-51-18)

2. Assigned:

13 February 1951

3. Status:

Current

4. Mission:

This project is directed toward conclusions concerning the role of tactical air forces in support of ground operations. Air missions against ground forces in the combat zone, the role of air to ground weapons in close support of ground weapons in ground action and the effects upon the balance of ground forces of air superiority or air inferiority will be scientifically analyzed.

5. Major Conclusions:

- a. The Polaroid Land Spotter Camera provides a very considerable improvement on the existing method of making available to the front-line commander pictorial evidence of what opposes him to his immediate front.
- b. The Air Support Weapons Effectiveness Trials at Fort Bragg in July 1951 did not provide the data required to assess the effectiveness of the weapons under trial.
- c. ORO - FEC, Project No. 2 (Air Support of Ground Forces) concluded in ORO-R-3(FEC) that:
 - (1) Close air support operations have been conducted with increasing efficiency in both the Air Force and Navy.

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In addition to the many recent improvements several others are being implemented.

(2) The Air Force effort in support of the Army has decreased from an initial 41 sorties per US division per day at the Pusan perimeter to less than 15 sorties per US division per day in December and January. Of these sorties classified by Air Force as close support, roughly 50 percent for the entire period were outside the bomblines and, in this report, are not considered close support. For the entire period, the Army has had an average of 13 close support sorties per division per day inside the bomblines. Close support has averaged 37 sorties per day for the First Marine Division.

(3) The 37 Marine F-4U aircraft have dropped a daily average of 7 1/3 tons of bombs, 160 rockets and 14 napalm tanks. The 13 Air Force aircraft have dropped daily an average of 1 1/2 tons of bombs, 36 rockets and 5 napalm tanks.

(4) Both Marines and Air Force have attacked the same types of close support targets with the emphasis, by numbers of targets, on troops, huts, and buildings. The Marines attack more troops and guns, and fewer huts and buildings than does the Air Force.

(5) Marine close-support aircraft attack targets much closer to the front line, arrive at the target more quickly after request, and stay in the area much longer than Air Force aircraft.

(6) The Mosquito system of control has exploited attacks on targets averaging five miles behind the lines and can locate targets and control attacks over a very large area behind the lines.

(7) The Army should have the capability of applying close air support within 5 - 10 minutes on targets near friendly positions.

- (8) Actual damage to targets has not been determined (with the exception of the tanks destroyed in Korea prior to November). Ground assessment, photographic interpretation, and interrogation of POWs should be used to determine the damage and should be coordinated with each other.
- (9) Ground weapons have many times the equivalent firepower of the close air support in Korea for targets both large and small in area; advantages of air weapons in mobility and psychological effectiveness have not been evaluated.
- (10) Air-ground communications are severely limited in range because of terrain and, particularly in the Army Air Force system, are sometimes unreliable because of inadequate maintenance and supply.
- (11) Jet aircraft are suitable for Mosquito-controlled ground attack, although the propeller-type aircraft used in Korea are superior in endurance and load-carrying capacity. In the Marine system of control close support, the present jet aircraft would be unsatisfactory because their low endurance would preclude their use as on-station aircraft.
- (12) The T-6 aircraft is not a suitable aircraft for Mosquito operations.
- (13) Mosquito operations furnish a valuable source of combat intelligence. At present, only a small part of this intelligence is reaching the division level and lower, where it would be particularly useful.
- (14) The approval of individual close support target requests and, in general, intra-corps close support plans and operations should be handled at corps level or lower. To accomplish this, the JOC and associated sections should retain responsibility only for inter-corps priorities. Of course, the TACC should continue to allocate aircraft.

(15) FACs are assigned to Eighth Army for only a very short tour of duty without previous training as controllers, and as a result are usually inefficient for several days after arrival.

(16) The effectiveness of close support operations would be greatly increased by judicious use of reconnaissance photography at large scale (about 1:2000) and photo interpretation in order to locate targets, and in particular to determine the build-up of troop targets.

(17) Effective close air support operations at night appear feasible using B-29 aircraft.

(18) Use of chemical warfare weapons in Korea would increase the effectiveness of air support operations.

(19) The employment of atomic bombs in close air support operations in Korea would dwarf current operations with respect to tactical effectiveness.

(20) While the most important mission of tactical aircraft is undoubtedly that of maintaining air superiority, interdiction and close support are also of great importance, and are complementary missions. Sufficient data on the effectiveness and cost of close support are not yet available to permit a determination of the optimum amount of close air support required for ground operations.

(21) The two most important close support problems currently needing attention are:

- a) Intelligence -- location and identification of targets.
 - b) All weather attack -- night and bad weather attack, minimum altitude navigation.
- d. On the basis of interrogations of prisoners of war it was concluded that in attacks on personnel in camps and on the road:
- (1) Rockets are significantly less effective than napalm and probably less effective than strafing and bombs.

- (2) Strafing is marginally effective in comparison with napalm and probably less effective than bombs.
- (3) There is no significant difference in effectiveness between napalm and bombs.
- (4) There does not appear to be a significant difference between the jet fighter bomber, propeller driven fighter bombers, or the light bomber given the same type of weapons.

6. Recommendations:

- a. The Army should place Land Spotter Cameras in service as soon as possible. Further experiments to produce the ideal spotter camera should be conducted.
- b. In any future trials of the effectiveness of air support weapons, the experiment should be set up on a statistically sound basis to ensure valid results.
- c. ORO-FEC Project No. 2 recommended in ORO-R-3 (FEC) that:
 - (1) On a trial basis, in at least one division in Korea, the Air Force should immediately modify its present system of close support to give the Army the capability of applying close air support upon targets near friendly positions within 5 to 10 minutes after request, using artillery forward observers or ground controllers, at battalion level, to locate targets and control strikes from the ground. To achieve this, on-station aircraft should be made available to this division, the object being to determine the minimum additional personnel and equipment required to provide this capability to the Army.
 - (2) At least two RF-51 reconnaissance aircraft should be assigned to take after-strike photographs of close support targets for a period of at least a month.

- (3) A ground team to assess damage to ground targets by air and ground weapons should be organized at each corps in the Eighth Army.
- (4) An increased effort should be made to obtain all possible information on the damage to ground targets by air and ground weapons.
- (5) Detailed planning for close support operations, exclusive of allocation of aircraft, should be done at corps level or lower: To accomplish this planning a TADC and an FSCC should be established at each corps.
- (6) FACs should be given adequate training in the control of air strikes and assigned for a longer tour of duty.
- (7) Requirements for a Mosquito aircraft should be determined and a suitable aircraft developed.
- (8) Air-ground and ground-ground radio communications in mountainous terrain should be studied intensively on an urgent basis with a view to furnishing equipment less severely limited in range than is the present equipment.
- (9) A decision be made whether or not air support operations to maintain air superiority are to be planned sufficiently independently of interdiction and close support operations to permit a separate requirement for close support.
- (10) Until the decision is made as in the preceding recommendation, an interim basic requirement for close support of Army operations should be set at 12 sorties per division per day, which is approximately the average number of close support sorties for all operations in the Korean campaign to date and necessary deviations from this number accomplished by coordination with the interdiction air support operations.

(11) Combat intelligence obtained by Mosquito operations should be made available to the front-line ground commanders in the most expeditious manner; for example, by message drop on the command post.

(12) A joint intelligence center should be established to provide for rapid collection, integration, and dissemination of all intelligence information.

(13) Research and development in the ZI assign highest priority to development of techniques and equipment for location and identification of targets, particularly from the air.

(14) Research and development in the ZI assign highest priority to development of techniques and equipment for improving all-weather methods of air navigation and air attack on ground targets.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. Procurement of Land Cameras has been initiated and will result in introduction to Divisional units in Korea this summer.
- b. The following actions have been taken in FECOM:
 - (1) Extensive use of B-29 and B-26 aircraft for night close support operations with control by MPQ-24 radar control has been instituted.
 - (2) The tour of duty of the FACs has been increased to 60 days.
 - (3) The radio jeep used by the TACPs has been modified to include an additional 8-channel VHF radio set.
 - (4) Each division has formed FSCCs consisting of the FDC, G3 Air and the ALO.
 - (5) Special attempts are being made by intelligence and operations sections to obtain data on the effectiveness of both day and night close air support.

NOTE: It should be remarked that many of the changes noted, which are in accordance with ORO recommendations, were probably quite coincidental and are not to be credited entirely to this project's report. However, this project did contribute materially to a change with respect to the use of B-29 aircraft for night close support operations and also toward developing an increased alertness of Army units in Korea to the value of obtaining effective data for operational research duties.

8. Publications:

ORO-T-133	Close Support Photography for Front Line Units (CONFIDENTIAL)
ORO-T-13(FEC)	A Study of the Effectiveness of Air Support Operations in Korea (SECRET)
ORO-R-3(FEC)	Close Air Support Operations in Korea (SECRET)

9. Staff Members:

Mr. L. D. Yates
Major E. G. Kelley (USAF)
Mr. A. C. Christman, Jr.
Mr. P. M. Hosé (Assigned to ORO-FEC)

10. Subcontractors:

Yale University (Dr. E. Pollard and Dr. F. Hutchinson)
Subject — Study of Electronic Aids to Technical Air Operations.

American Power Jet Company (Dr. G. Chernowitz and Mr. A. Moore) Subject — Effectiveness of Air-Ground Weapons.

Smith and Davis (Dr. E. Smith and Mr. T. Davis) Subject — Effectiveness of Air-to-Ground Rockets.

Booz, Allen and Hamilton (Dr. R. Evaldson) Subject — Cost Study of Medium Bomber Wing.

Columbia Research and Development Company (Mr. W. A. Gunn)
Subject — Evaluation of Weapons Effectiveness in Korea.

D. J. Belcher and Associates (Dr. Donald J. Belcher) Subject —
Analysis of Photo Intelligence.

11. Consultants:

D. J. Belcher

12. Plans for FY53:

- a. A major study will be instituted of the vulnerability to enemy air attack of the US Army logistic system and forces in the field. The effects of the US air interdiction program in Korea will be studied in the light of the enemy transportation and stockpile system and the tactical situation.
- b. Continued emphasis will be given to the analysis of aerial photo intelligence.
- c. Continued emphasis will be given to the combat weapons effectiveness study and to cost and effectiveness comparison of airborne weapons systems and ground weapons systems.
- d. The study of the use of electronic aids to night and bad weather air operations will be completed.
- e. Consideration will be given to evaluation of close support techniques including information developed under b, c, and d.

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13. Contents of this item deleted.

SECURITY **SECRET** INFORMATION

SPECIAL STUDY

SECRET

SPECIAL STUDY1. Project Name and Number:

HUMAN BEHAVIOR (No number assigned)

2. Assigned:

15 August 1950

3. Status:

Completed 30 June 1951

4. Mission:

Preparation of a series of monographs covering all items in a master plan on Human Behavior under the Conditions of Military Service, working under RDB in conjunction with Air and Navy representatives.

5. Major Conclusions:

The monographs produced were intended to be expository and informative summaries of existing knowledge, rather than to reach conclusions in support of recommendations.

6. Recommendations:

None

7. Actions Taken by the Army on Basis of Study Results:

None

8. Publications:

The publications listed were prepared by ORO staff members, consultants or subcontractors as contributions to a cooperative

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project under the auspices of the Research and Development Board. The entire set of monographs, under an over-all report, is to be published to all of the interested defense agencies. ORO will make separate publication of a small number of copies of the items listed as a separate publication, for Army agencies most directly interested.

American University, Bureau of Social Sciences Research

Optimum Age for Military Service.

Community Organization.

Communications Theory.

Andrews, T. G. Communications and Readability.

Andrews, T. G., and Hackman, Ray.

Fatigue.

Panic: An Analysis for Military Purposes.

Covner, B. J., and Orlansky, J.

Small Arms Training.

Training Aids and Devices.

Davis, Kingsley. Demographic Aspects of Manpower.

Deese, James. Skilled Behavior under Conditions of Stress.

Hawley, A. H. Community Factors in Procurement of Military Personnel.

Janowitz, Morris. A Brief Summary Statement of Some Sources of Emotional Maladjustment in American Culture from the Point of View of Military Management.

Kluckhohn, Clyde. American Culture and Military Life.

Linebarger, Paul. Foreign Milieux.

Mandelbaum, David G.

Group Dynamics of Military Units.

Utilization of Negro Manpower.

Miller, Neal E.

Fear and Courage in Training and Combat.

Selection of Men Who Will Be Courageous in Combat.

Murdock, G. P. The Caste Division in the Military Services.

Stephens, J. M. Summary of the Literature on General
Motivation and Incentives for Basic Training.

Truman, David B. The Function in Combat of Attitudes Toward
War With Specific Nations.

Yarnold, Kenneth, and Orlansky, Jesse.

Interchangeability and Standardization of Weapons. Material
and Design: A Human Engineering Evaluation.

Special Training Devices.

Williams, Richard H. Review of Research in Human Resources
Relating to the Creation of Effective Com-
bat Forces.

9. Staff Members:

Dr. Richard Williams

10. Subcontractors:

American University
Dunlap and Associates

11. Consultants:

Andrews, Thomas G.
Davis, Kingsley
Deese, James E.
Hackman, Ray
Hawley, Amos H.
Janowitz, Morris

Kluckhohn, Clyde
Linebarger, Paul M. A.
Mandelbaum, David G.
Miller, Neal E.
Murdock, George P.
Stephens, John M.
Truman, David B.

12. Plans for FY53:

Final paper on this subject will be published in Fiscal Year 1953.

13. Contents of this item deleted.

FECOM PROJECTS

Plans for FY53:

It is the expectation of ORO to continue a field team in the Far East Command, as long as operations continue in that theater. The hostilities serve as a valuable laboratory for the gathering of data under actual combat conditions. The possibility of using this as an even more effective laboratory by conducting test operations of a character designed to "separate the variables" will be thoroughly explored.

The work program will vary in emphasis from time to time in accordance with the importance attached to the various field projects. These latter include such major areas and problems as combat communications, logistics, weapons effectiveness, guerilla warfare, military government, psychological warfare, and various aspects of infantry operations.

There can be no explicit statement of the number of personnel which will be required and desirable for the execution of these plans. Built around a core of key personnel, there will be supplementary adjustments to meet the needs of the projects in operation.

1. Project Name and Number:

ORO-FEC, Project 1. Tactical Use of Atomic Weapons

2. Assigned:

10 September 1951

3. Status:

Complete

4. Mission:

This study is designed to provide, within a few weeks, an SOP for the use of existing atomic bombs in support of ground operations. The SOP will include a study of the required G-2 information, the military effects and effectiveness of the explosions, and our own safety measures. This study will be closely correlated with Project 2, which will provide much of the necessary data. This study may be critically required in the event NK forces are reinforced by Communist China of the USSR.

5. Major Conclusions:

- a. Detailed studies of combat situations in Korea showed that the Communist Forces repeatedly offered troop targets for which the assessed casualties would average 2,000 to 3,000 killed and an additional equal number seriously wounded per atomic weapon expended. CCF troops in close reserve have been massed on occasion to an extent that 15,000 casualties might have been inflicted by a single 40 KT weapon.
- b. Offensive troop concentrations reach maximum vulnerability at jump-off. Thus, the CCF breakthrough on the I and IX Corps sectors of Line Baker could have been changed into a disastrous CCF defeat by the timely use of six atomic air

bursts over pre-selected aiming points shortly before midnight on 31 December 1950.

- c. On the average, UN forces on the defensive would have suffered casualties of 1,000 to 1,200 killed and an equal number of seriously-injured per atomic weapon expended against them.
- d. In addition to UN frontline and reserve troops, all supply ports, principal depots, POL, aircraft and airfields, and corps and army headquarters of the UN forces in Korea are highly vulnerable to disaster through atomic attack. This vulnerability is further magnified by the nearly complete lack of atomic indoctrination among junior officers and enlisted men, and by the absence from the theater of medical supplies and facilities adequate for the treatment of atomic casualties.
- e. Both in cost and in effectiveness, carpet bombing and area artillery fire fail by large factors to compete with atomic weapons as a means for attacking large area ground-force targets.
- f. Atomic weapons offer for the first time available means for attacking very large areas, including enemy's rear, with maximum coverage of targets by attacks delivered in minimum forces.
- g. Present intelligence procedures are adequate for the timely evaluation of enemy atomic targets only for stable or quasi-stabilized situations near friendly lines. Improvements along lines suggested in Appendix C of ORO-R-2 (FEC) will be required before atomic weapons can be used with optimum effectiveness in fluid situations or against enemy troops in reserve or assembly areas.
- h. The tactical employment of atomic weapons in appreciable numbers will force significant changes in Army training, organization, equipment, logistics, intelligence, and tactics.

- i. Present capabilities in stockpile weapons, medium bombers, and electronic guide-in equipment (MPQ-2) for planes are adequate for the use of atomic weapons in close support of troops in stabilized positions. However, the time required at present, between the identification of troop targets and feasible strikes by medium bombers flying from distant airfields, would have prevented timely atomic attacks on a large fraction of the CCF and NKA troop targets studied in Korea.
- j. In general, the operations, logistics, and intelligence staffs of the Army and the Air Force are not yet adequately organized or prepared to plan or execute effective atomic attacks on a decisive scale against ground force targets.

6. Recommendations:

- a. The Army should plan for 10 atomic warheads per opposing enemy division, of which approximately half would be used directly against enemy troops and half against his support and services.
- b. Atomic indoctrination should be completed for all officers and enlisted men and should be made a part of basic training for all recruits in order to prepare them for self-protective measures in the event of atomic attack.
- c. Army medical depots should pre-package, for air shipment, medical supplies specially adapted for casualties resulting from atomic warfare.
- d. Atomic warheads for delivery by fighters, light bombers, or guided missiles operating from airstrips or launching sites located in corps area should be provided in order to minimize delivery time of atomic weapons.
- e. Emphasis should be given to the development of short and medium range surface-to-surface guided missiles suitable for the replacement of artillery as a primary all-weather means for delivering atomic weapons in support of ground forces.

- f. Priority should be given to the intensive training of all Army staff officers from corps to theater level in planning and executing atomic attacks and tactics. The capacity of present staff schools for atomic indoctrination and training should be strongly increased.
- g. Atomic weapons should be simulated in all future army maneuvers and training exercises.
- h. A JOINT TACTICAL WEAPONS CONTROL SYSTEM should be organized with present Joint Operation Centers (JOC) and Fire Support Coordination Centers (FSCC) as basic elements, for planning, coordinating, and evaluating atomic attacks (and other close support operations) delivered by Army or Tactical Air Force units.

7. Action Believed Already Taken by Army on Basis of Study Results:

- a. ORO studies made in Korea, and the reports and numerous briefings based on these studies, have undoubtedly been definite factors in present Army, Air Force, and AEC plans to increase the production of fissionable materials and to develop new atomic weapons for tactical use.
- b. ORO studies, particularly ORO-T-1 (FEC) and ORO-R-2 (FEC), are in use as basic references in the staff officer training courses conducted at Sandia Base.
- c. In Exercise SOUTHERN PINE, the CPX conducted by Army and Air Force officers for Army Field Force on the tactical use of atomic weapons was based primarily on organization and procedures recommended in ORO-R-2 (FEC).
- d. A CPX, similar to paragraph c above, will be conducted by AFF, EUCOM, Seventh Army, and the Command and General Staff School Officers following the current training maneuvers of the Seventh Army in Europe.
- e. The Deputy Chief of Staff, Army, has ordered that the use of atomic weapons be simulated in all future Army maneuvers

and training exercises in accordance with an ORO recommendation:

"This Headquarters is continuing study of subject report with a view to taking any actions that may be indicated to prepare the Far East Command offensively and defensively for possible employment of atomic weapons.

"... All phases of the report should be of great value to commanders from theater through corps anywhere.

"... Appropriate parts of the report, such as the portions pertaining to the use of cover, troop deployment, and selection of terrain, should be extracted and included in the training and schooling of all non-commissioned and commissioned officers."

- f. EUCOM has requested a field team to conduct a study of the employment of tactical A-weapons in the defense of Western Europe.

8. Publications:

ORO-T-1 (FEC) TEABK (TOP SECRET)

ORO-R-2 (FEC) Tactical Employment of Atomic Weapons,
1 March 1951 (SECRET)

9. Staff Members:

Jerome B. Green, Chairman
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Charles Billingslea
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10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY 53:

No further work contemplated.

1. Project Name and Number:

ORO - FEC Project No. 2 (Air Support of Ground Forces)

2. Assigned:

10 September 1950

3. Status:

Current

4. Mission:

- a. The mission of this project is to investigate close air support operations in Korea in order to determine:
 - (1) The damage to the enemy.
 - (2) The adequacy of organization, control techniques, and equipment to integrate air effort with ground operations.
 - (3) Principles applicable to the general problem of planning close air support operations in other possible combat theaters.

5. Major Conclusions:

- a. Close air support operations have been conducted with increasing efficiency in both the Air Force and Navy. In addition to the many recent improvements several others are being implemented.
- b. The Air Force effort in support of the Army has decreased from an initial 41 sorties per US division per day at the Pusan perimeter to less than 15 sorties per US division per day in December and January. Of these sorties classified by Air Force as close support, roughly 50 percent for the entire

period were outside the bomblines and, in this report, are not considered close support. For the entire period, the Army has had an average of 13 close support sorties per division per day inside the bomblines. Close support has averaged 37 sorties per day for the First Marine Division.

- c. The 37 Marine F-4U aircraft have dropped a daily average of $7 \frac{1}{3}$ tons of bombs, 160 rockets, and 14 napalm tanks. The 13 Air Force aircraft have dropped daily an average of $1 \frac{1}{2}$ tons of bombs, 36 rockets, and 5 napalm tanks.
- d. Both Marines and Air Force have attacked the same types of close support targets with the emphasis, by numbers of targets, on troops, huts, and buildings. The Marines attack more troops and guns, and fewer huts and buildings than does the Air Force.
- e. Marine close-support aircraft attack targets much closer to the front line, arrive at the target more quickly after request, and stay in the area much longer than Air Force aircraft.
- f. The Mosquito system of control has exploited attacks on targets averaging five miles behind the lines and can locate targets and control attacks over a very large area behind the lines.
- g. The Army should have the capability of applying close air support within 5-10 minutes on targets near friendly positions.
- h. Actual damage to targets has not been determined (with the exception of the tanks destroyed in Korea prior to November). Ground assessment, photographic interpretation, and interrogation of PWs should be used to determine the damage and should be coordinated with each other.
- i. Ground weapons have many times the equivalent firepower of the close air support effort in Korea for targets both large and small in area; advantages of air weapons in mobility and psychological effectiveness have not been evaluated.

- j. Air-ground communications are severely limited in range because of terrain and, particularly in the Army-Air Force system, are sometimes unreliable because of inadequate maintenance and supply.
- k. Jet aircraft are suitable for Mosquito-controlled ground attack, although the propeller-type aircraft used in Korea are superior in endurance and load-carrying capacity. In the Marine system of control of close support, the present jet aircraft would be unsatisfactory because their low endurance would preclude their use as on-station aircraft.
- l. The T-6 aircraft is not a suitable aircraft for Mosquito operations.
- m. Mosquito operations furnish a valuable source of combat intelligence. At present, only a small part of this intelligence is reaching the division level and lower, where it would be particularly useful.
- n. The approval of individual close support target requests and, in general, intra-corps close support plans and operations should be handled at corps level or lower. To accomplish this, the JOC and associated sections should retain responsibility only for inter-corps priorities. Of course, the TACC should continue to allocate aircraft.
- o. FACs are assigned to Eighth Army for only a very short tour of duty without previous training as controllers, and as a result are usually inefficient for several days after arrival.
- p. The effectiveness of close support operations would be greatly increased by judicious use of reconnaissance photography at large scale (about 1:2000) and photo interpretation in order to locate targets, and, in particular, to determine the build-up of troop targets.
- q. Effective close air support operations at night appear feasible using B-29 aircraft.

- r. Use of chemical warfare weapons in Korea would increase the effectiveness of air support operations.
- s. The employment of atomic bombs in close air support operations in Korea would dwarf current operations with respect to tactical effectiveness.
- t. While the most important mission of tactical aircraft is undoubtedly that of maintaining air superiority, interdiction, and close support are also of great importance, and are complementary missions. Sufficient data on the effectiveness and cost of close support are not yet available to permit a determination of the optimum amount of close air support required for ground operations.
- u. The two most important close support problems currently needing attention are:
 - (1) Intelligence — location and identification of targets.
 - (2) All-weather attack — night and bad weather attack, minimum altitude navigation.
- v. On the basis of interrogations of prisoners of war it was concluded that in attacks on personnel in camps and on the road:
 - (1) Rockets are significantly less effective than napalm and probably less effective than strafing and bombs.
 - (2) Strafing is marginally effective in comparison with napalm and probably less effective than bombs.
 - (3) There is no significant difference in effectiveness between napalm and bombs.
 - (4) There does not appear to be a significant difference between the jet fighter bomber, propeller-driven fighter bombers, or the light bomber given the same types of weapons.

6. Recommendations:

- a. On a trial basis, in at least one division in Korea, the Air Force should immediately modify its present system of close support to give the Army the capability of applying close air support upon targets near friendly positions within 5 to 10 minutes after request, using artillery forward observers or ground controllers, at battalion level, to locate targets and control strikes from the ground. To achieve this, on-station aircraft should be made available to this division, the object being to determine the minimum additional personnel and equipment required to provide this capability to the Army.
- b. At least two RF-51 reconnaissance aircraft should be assigned to take after-strike photographs of close support targets for a period of at least a month.
- c. A ground team to assess damage to ground targets by air and ground weapons should be organized at each corps in the Eighth Army.
- d. An increased effort should be made to obtain all possible information on the damage to ground targets by air and ground weapons.
- e. Detailed planning for close support operations, exclusive of allocation of aircraft, should be done at corps level or lower. To accomplish this planning, a TADC and FSCC should be established at each corps.
- f. FACs should be given adequate training in the control of air strikes and assigned for a longer tour of duty.
- g. Requirements for a Mosquito aircraft should be determined and a suitable aircraft developed.
- h. Air-ground and ground-ground radio communications in mountainous terrain should be studied intensively on an urgent basis with a view to furnishing equipment less severely limited in range than is the present equipment.

- i. A decision be made whether or not air support operations to maintain air superiority are to be planned sufficiently independently of interdiction and close support operations to permit a separate requirement for close support.
- j. Until the decision is made as in the preceding recommendation, an interim basic requirement for close support of Army operations should be set at 12 sorties per division per day, which is approximately the average number of close support sorties for all operations in the Korean campaign to date, and necessary deviations from this number accomplished by coordination with the interdiction air support operations.
- k. Combat intelligence obtained by Mosquito operations should be made available to the front-line ground commanders in the most expeditious manner; for example, by message drop on the command post.
- l. A joint intelligence center should be established to provide for rapid collection, integration, and dissemination of all intelligence information.
- m. Research and development in the ZI assign highest priority to development of techniques and equipment for location and identification of targets, particularly from the air.
- n. Research and development in the ZI assign highest priority to development of techniques and equipment for improving all-weather methods of air navigation and air attack on ground targets.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. Extensive use of B-29 and B-26 aircraft for night close support operations with control by MPQ-24 radar control has been instituted.
- b. The tour of duty of the FACs has been increased to 60 days.

- c. The radio jeep used by the TACPs has been modified to include an additional 8-channel VHF radio set.
- d. Each division has formed FSCCs consisting of the FDC, G-3 Air and the ALO.
- e. Special attempts are being made by intelligence and operations sections to obtain data on the effectiveness of both day and night close air support.

NOTE: It should be remarked that many of the changes noted above, which are in accordance with ORO recommendations, were probably quite coincidental and are not to be credited entirely to this project's report. However, this project did contribute materially to a change with respect to the use of B-29 aircraft for night close support operations and also toward developing an increased alertness of Army units in Korea to the value of obtaining effective data for operational research studies.

8. Publications:

ORO-R-3 (FEC) Preliminary Evaluation of Close Air Support Operations in Korea (SECRET)

ORO-T-13 (FEC) A Study of the Effectiveness of Air Support Operations in Korea (SECRET)

9. Staff Members:

P. M. Hose

10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY 53:

- a. Work on the effectiveness and accuracy of night close support operations with MPQ-2 control will be completed.
- b. The relative effectiveness of air weapons in use in Korea will be studied.
- c. The preliminary evaluation of close support in Korea will be supplemented to as great an extent as is possible depending upon the nature of warfare in Korea.

1. Project Name:

ORO-FEC, Project 3 (ARMOR)

2. Assigned:

July 1950

3. Status:

Current

4. Mission:

To evaluate the employment of armor in Korea, to draw conclusions therefrom and to recommend logistic action to improve effectiveness of armor.

5. Major Conclusions:

- a. Tanks are an important part of the Army's forces.
- b. Over-all, the M4 was the best tank for the specific job in Korea. This tank, the M26, and M46, were superior to the Soviet T34/85 as manned and used by the North Koreans.
- c. Mechanical reliability of all tanks, but especially the M46, was unacceptable. About 60 percent of all casualties were due to this cause; 16 percent due to mines and 24 percent to all other causes.
- d. Night fighting capabilities of our armor were inadequate.
- e. Communications between tanks and infantry and battalion CPs were deficient.
- f. Use of tanks in the antitank role and for convoy protection was uneconomical.

- g. The Air Force accounted for about 42 percent of all enemy tank casualties, with napalm being its most effective weapon. There is reason to believe that the effectiveness of napalm can be reduced by the enemy by appropriate technical and training changes. Army forces were credited with 24 percent, and all others (including abandonments and unknown) were 34 percent. Of this latter group, Army forces, by virtue of tactical successes, can be credited with a major portion.
- h. Land mines were the most effective weapons of the enemy, causing 155 casualties or 16 percent; NK laying methods, especially random use, were crude but effective. US uses of mines were poor to mediocre in effectiveness; there is evidence that the Land Mine study which recommended more effective mines, including offensively-laid mines, would have paid off in Korea.

6. Recommendations:

- a. Recommended use in weapon system analysis from a general point of view.
- b. Recommended concentration on a medium 35-ton tank development for maximum effectiveness of armor in the Army. This includes a thorough study to compare a lighter, more economical tank (with a mechanical transmission vs a hydraulic) with the current M46 series.
- c. Recommend measures for tank mechanical simplification, and a review of the usefulness of stabilizers, cant correctors, and range finders.
- d. Required: technical means for better night fighting.
- e. Required: better equipment and training for communications.
- f. Recommend a battalion antitank weapon, effective at 1,000 yd for the infantry; the Cobra or similar weapon indicated.

- g. Previous recommendations for more effective mines and new methods of employment were substantiated by Korean experience.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. Results are being used as a source of information by various Army organizations.
- b. The Army has speeded up its prototype evaluation of the T42 medium tank, to compare to the M46 series.
- c. Work is underway to improve night fighting capabilities and communications.
- d. The need for a cheaper antitank weapon for infantry than organic tanks has been recognized by AFF requirements for a battalion antitank weapon.
- e. The land mine research and development program implements both the "Employment of Land Mine" study and the Korean recommendations for more effective mines.

8. Publications:

ORO-R-1 (FEC) The Employment of Armor in Korea, Volumes I and II. (SECRET)

9. Staff Members:

James W. Johnson
E. A. Johnson
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C. Billingslea
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10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY 53:

Project ARMOR will continue present work in Korea with approximately three professional staff members. Resultant publications will appear periodically as ARMOR reports from Korea.

1. Project Name:

ORO-FEC, Project 4 (POWOW)

2. Assigned:

September 1950

3. Status:

Current

4. Mission:

Evaluation of methods and results of the propaganda leaflet campaign, the use of the polygraph (lie-detector) technique to screen natives and test prisoners of war, strategic radio PSYWAR in the FEC, the use of airborne loudspeakers, the effect of PSYWAR on enemy troops, and a number of related subjects:

5. Major Conclusions:

a. Doctrine and Organization

(1) Psychological warfare as it was conducted in FEC at first was a virtually distinct and separate operation against the enemy directed principally towards obtaining surrenders. (See Recommendation a.)

(2) "Tactical" psychological warfare within Eighth Army was such only in the sense that dissemination of its output is conducted with an eye to tactical intelligence. It was not otherwise geared into tactical operations. (See Recommendation a.)

(3) The organizational structure of psywar in both FEC and EUSAK at the time of study appeared to be the result of a series of resourceful improvisations and adaptations rather than of advance planning within FEC. Consequently, much of the training, equipping, and staffing of units, like the 1st Radio Broadcasting and Leaflet Group as well as the 1st Loudspeaker and Leaflet Company, in the ZI had only indirect value since these units had to be organized in the field in order to fit them into pre-existing theater and army level arrangements. (See Recommendation d.)

(4) Policy guidance within FEC's psychological warfare organization appears to be too general, i. e. it is keyed to US State Department's Foreign Information Policy Guidelines and tends not to focus specifically on military problems in such fashion as to be of maximum use to operating personnel. (See Recommendation b.)

(5) Control in FEC over the content of radio programs appears to be likewise too general while, on the other hand, that exercised over leaflet operations appears to be too specific and detailed. (See Recommendation c.)

(6) In general, psychological warfare in both FEC and EUSAK is keyed to a local situation to such an extent and on so many significant points that its value as a prototype for planning other psychological warfare operations is limited. (See Recommendation e.)

b. Planning and Intelligence

(1) "Tactical" psychological warfare planning within Eighth Army is accomplished with little regard to the cultural and psychological peculiarities of the target audience. (See Recommendation g.)

(2) There is an almost complete lack of relevant language and area training among the US personnel employed in both the FEC and the EUSAK psychological warfare operations, the effect of which is to render difficult accurate

judgments not only as to what should be said to the target audience but even as to what is being said. (See Recommendation f.)

(3) Library materials and facilities available to operators in the field are inadequate. (See Recommendation f.)

(4) Closely related to the two foregoing conclusions is the fact that psychological warfare intelligence in FEC and EUSAK is still inadequate as to concept, doctrine, training, and operation. This is particularly true in connection with the "strategic" radio operation, where the intelligence support needed is plainly not available. (See Recommendation g.)

(5) There is a need for at least one full-time psywar officer in each combat division as part of its authorized personnel. (See Recommendation h.)

c. Effectiveness

(1) The impact of propaganda leaflets appears to have been greatest when their content gave assurance of good treatment of prisoners.

(2) A minority of approximately 18 percent of front-line US troops have distinctly unfavorable personal attitudes toward prisoners and favor a policy of retaliation against the enemy prisoners for mistreatment of US prisoners. (See Recommendations i. and j.)

(3) The group interview method may be profitably used in pretesting leaflets.

(4) Leaflets dealing with immediate and practical situations, e. g. leaflets outlining surrender procedure and providing a surrender map, appear to be better understood than, and preferred to leaflets dealing with abstract concepts such as independence and national unity.

- (5) Response by Chinese POWs showed to a considerable degree that their inability to answer questions concerning leaflets was due to failure to comprehend the leaflet message.
- (6) Chinese Communist forces appear to be more susceptible to influence by propaganda leaflets than North Korean soldiers.

d. Psychological Impact of Weapons

- (1) Among the weapon classes, air and artillery weapons evoke the greatest number of enemy fear reactions.
- (2) Prior exposure to any particular weapon class does not appear to correlate with adverse reaction to it.
- (3) Of all the weapons studied, napalm and white phosphorus were particularly outstanding for the fear reactions they evoked. This fact, considered in the light of some estimates of the kill potential of napalm, is very striking. (See Recommendation k.)

6. Recommendations:

- a. Continuous attention should be given to the problem of whether surrender-mission psywar represents maximum exploitation of this weapon; and planning for future psywar operations, including the organization, training and equipping of personnel should be such as will not preclude the pursuit of broader missions.
- b. The policy considerations which govern the psychological warfare output of FEC as a whole should be translated into specific guidance on military problems for lower echelons.
- c. Control in FEC over leaflet operations should be decentralized to a greater degree while control over radio operations should be increased on the matter of program content.

- d. Consideration should be given to the possibility of introducing flexibility in psychological warfare organization by recruiting, training, and equipping incremental units in the ZI to be supplied to theater on an augmentation basis.
- e. Direct application of lessons from the Korean psychological warfare experience to other possible theaters should be made with the utmost caution in view of the many unique factors which condition the psywar effort in FEC and EUSAK.
- f. Psywar units should be equipped to exploit the cultural-psychological peculiarities of their target audience through better library facilities, through the production in the ZI of area manuals tailored to their needs, through more skillful use of panels of prisoners, and through the recruitment or training of thoroughly bilingual US officers to the extent that there could be at least one such officer at army level in each relevant foreign language.
- g. Immediate steps should be taken in FEC to revamp the psywar intelligence processes in order to relate them more closely to the mission of the psychological warfare operation as a whole and to the specific needs of operations personnel.
- h. Necessary steps should be taken to have at least one full-time psywar officer assigned to each combat division.
- i. Consideration should be given to a program of indoctrination of US troops on the treatment of prisoners with a view to bringing troop attitudes more nearly in line with official policy.
- j. Study of the problem of treatment of prisoners of war should be expanded and intensified so as to include the attitudes and opinions of US rear echelon troops and more detailed information on the bases of those attitudes and opinions.

- k. Research to discover and exploit the psychological impact of conventional weapons should be increased and in connection with this the psychological uses of conventional weapons and the possible value of auxiliary gadgets as, for example, noisemakers to be used with bombs, should be explored.

The above listed recommendations are only a few of the more important ones; a great many more detailed recommendations were also made.

7. Actions Believed Taken by the Army on Basis of Study Results:

- a. The Eighth Army accepted and implemented all major recommendations made as to the reorganization and expansion of the psywar effort in Korea. This included the transfer of psywar from G-2 to G-3, initially, with status as a staff section later. ORO personnel were requested to assist in the implementation of these recommendations by working directly with EUSAK, and a wide range of further recommendations were made and introduced into practice at EUSAK as a result.
- b. GHQ-FEC specifically accepted and implemented all major recommendations and took direct measures to implement them.

8. Publications:

- ORO-T-2 Possible Operations Research in FEC Psycho-
(FEC) logical Warfare (SECRET)
- ORO T-3 US Psywar Operations in the Korean War
(FEC) (SECRET)
- ORO-T-4 Strategic Radio Psywar in FEC
(FEC) (SECRET)

- ORO-T-19 Pretesting Procedures for Psychological Warfare Printed Media. Phase I: The Group Interview Method. (CONFIDENTIAL)
- ORO-T-20 FEC Psychological Warfare Operations: Radio (SECRET)
- ORO-T-21 FEC Psychological Warfare: Leaflets (SECRET)
- ORO-T-24 A Study of Enemy Soldier Attitudes Toward Communism, American Democracy and the United Nations (CONFIDENTIAL)
- ORO-T-26 Attitudes of US Combat Troops in Korea Toward the Taking and Treatment of Chinese and North Korean Prisoners of War (SECRET)
- ORO-T-28 FEC Psychological Warfare Operations: Intelligence (SECRET)

9. Staff Members:

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10. Subcontractors:

American Institute for Research
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11. Consultants:

T. G. Andrews
Denzel D. Smith
W. Schramm

12. Plans for FY53:

Plans for further work on psychological warfare in the Far East theatre are largely dependent on the future course of the war. Immediate plans call for more intensive analysis of the front-line tactical psychological warfare operations. If the war continues, more or less active, renewed analysis and evaluation of the general psychological warfare program may be undertaken. Evaluation work already done, largely directed toward the development of methods of evaluating the effect of psychological warfare operations, will also be brought into the stage of development of simplified instruments for quick measurement of effects as a running guide to the conduct of operations. More detailed discussion is given under the Summary for Project POWOW.

1. Project Name and Number:

ORO-FEC, Project 5. (Infantry Operations)

2. Assigned:

10 September 1950

3. Status:

Active

4. Mission:

The mission of Project 5 is to study infantry weapons systems, logistics, mobility, and tactics to determine how the effectiveness of our ground forces can be increased.

5. Major Conclusions:

Brig Gen S. L. A. Marshall, consultant with ORO, using the after-battle interview technique, compiled a large amount of data on infantry operations in Korea during the winter of 1950-51. From these data Gen Marshall was able to conclude that while, in general, the infantry within the Eighth US Army was as battle-worthy a foot force as we have yet produced, there is still much that can be done to further increase infantry effectiveness. Conclusions and recommendations made in this regard are too numerous and detailed to be listed in this summary. Suffice it to say that the Army has shown considerable interest in Gen Marshall's studies (ORO-T-7 EUSAK and ORO-R-5 FEC), and that many of his recommendations have been adopted.

6. Recommendations:

See 5. above.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. A concerted effort is being made to lighten the soldier's load by eliminating non-essential items of equipment.
- b. Current army training is being modified to better enable the infantryman to cope with the problems peculiar to combat in Korea. (See report on Project DOUGHBOY.)

8. Publications:

ORO T 7 (EUSAK) "Notes on Infantry Tactics in Korea"
(SECRET).

ORO R-13 "Analysis of Infantry Operations and
Weapons Usage in Korea during the Winter"
(SECRET).

ORO-T-190 "Operation Punch and the Capture of Hill 440,
Suwan Korea Feb 1950" (RESTRICTED).

9. Staff Members:

Brig Gen S. L. A. Marshall
Dr. E. A. Johnson
Mr. R. J. Best
Miss G. Donovan
Mrs. R. Voigt
Dr. B. R. Baldwin
Mr. F. L. Weldon

10. Subcontractors:

None

11. Consultants:

None

12. Plans for FY 53:

- a. Study on Use of Infantry Weapons and Equipment in Korea.
In the final stages of completion is a study based on the

results of interviewing 636 infantrymen who averaged 6 1/2 months of combat in Korea. Conclusions and recommendations will be made concerning the soldiers' clothing and equipment load, the M-1 rifle, ammunition, grenades, the bayonet, BAR, LMG, 3.5 rocket launcher, 57- and 75-mm recoil-less rifles, amount of basic training given in use of weapons, and effectiveness of enemy weapons.

- b. It is proposed that studies on infantry weapons effectiveness will continue as long as the Korean war exists.

1. Project Name:

ORO-FEC, Project 7.

2. Assigned:

16 September 1950

3. Status:

Field work completed March, 1951.

4. Mission:

Evaluation of service support in the Korean campaign. This evaluation to consider service support in the combat zone and the communications zone; the possibilities of reduction of service support through better utilization or elimination of certain services rendered; support in all branches of the Armed Services, and particularly inter-service support; the use of indigenous personnel as substitute for service support.

5. Major Conclusions:

- a. For the period from 5 July 1950 to 7 February 1951 an average of 22.2 percent of all troops in the combat zone were service troops; making an average of 43 percent service troops for the entire theater, a figure comparable to planning factors in Field Manual #101-10.
- b. Improvement could be effected by the following actions:
 - (1) The use of a Joint Operations Center for Logistics (ORO-T-6 FEC);
 - (2) The use of aerial ports controlled directly by Army for better utilization of airlift (ORO-T-6 FEC);

- (3) More intensive training of logistic cadres within the Army (ORO-T-6 FEC);
- (4) Initiating a program of controlled interdiction of LOCs back of enemy lines to save the LOCs for later friendly use (ORO-T-6 FEC);
- (5) Greater use of floating storage in direct support of troops (ORO-T-6 FEC);
- (6) Improving Army methods of handling indigenous labor (ORO-T-6 FEC);
- (7) Stockpiling equipment and supplies near threatened area to which troops could be flown when the threatened action became imminent or actually started (ORO-T-6 FEC);
- (8) Decentralizing technical service depots in the communications zone for better access to ports or rail terminals (ORO-T-6 FEC);
- (9) In periods of intensive combat activity, Class V expenditures impose the greatest burden on the logistics system in the forward areas. A limiting factor in logistical support during heavy combat operations in Korea has been transport capabilities over rough terrain forward of the railroads (ORO-T-15 FEC);
- (10) The US Army does not presently possess organic means for the close logistic support of front line troops in terrain inaccessible to motor vehicles. In Korea, the use of human cargo carriers is the best means of supplying front lines in such terrain. The helicopter, now coming into more general military use, shows great promise for the future (ORO-T-15 FEC);
- (11) The long distances between supply depots and the divisions have sometimes caused undesirable time lags in the delivery of supplies, particularly classes II and IV. Throughout much of the campaign, supply emphasis has been from front to rear, rather than from rear to front (ORO-T-15 FEC);

(12) Because of the lack of division railheads, the limitations of motor transport over a poor road network, and personnel deficiencies, forward supply points have frequently been immobile and inflexible in the face of rapidly changing tactical situations (ORO-T-15 FEC);

(13) The concentration of dock facilities and depots in the Pusan area creates inflexibilities in the supply system, and makes the entire logistics system extremely vulnerable. A heavy air attack on Pusan would cripple the UN logistical effort until beach sites and clearance facilities from them could become operative (ORO-T-15 FEC);

(14) Greater use of pipelines would increase supply capacity and flexibility. Use has been curtailed because of shortages of pipe, pumps, and other materiel (ORO-T-15 FEC).

6. Recommendations:

Implied in Conclusions listed in previous section.

7. Action Believed Taken by the Army on Basis of Study Results:

a. Action being taken by the Army on Conclusions 2, 3, 6, 7, 8, 9, 11, 14. (Note on 12: the situation has been largely static since ORO-T-15 (FEC) was published).

8. Publications:

ORO-T-6 (FEC) Evaluation of Service Support in the Korean Campaign (SECRET)

ORO T-15 (FEC) Combat Zone Logistics in Korea (SECRET)

9. Staff Members:

Richard B. Black
Wilbur A. Taylor
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Owen Mattingly

Joseph L. Sieg
Mary J. O'Brien
Alvin D. Coox

10. Subcontractors:

None

11. Consultants:

William Neilson
Robert O. Shreve

12. Plans for FY 53:

- a. Flexibility of Combat Area Logistics
- b. Dispersion to Reduce Vulnerability to Weapons of Mass Destruction. (FEC field work may augment work being done in ORO Washington.)

1. Project Name:

ORO-FEC, Project 8

2. Assigned:

October 1950.

3. Status:

Initial work in field completed 26 February 1951. Project continues active, with field personnel of several projects contributing. Further specific work may be undertaken.

4. Mission:

The mission was to study, with a view to recommend procedures, the ways and means of effectively and economically utilizing indigenous manpower for:

- a. Combat and service forces, separately;
- b. Combat and service forces, integrated;
- c. Civilian labor battalions.

5. Major Conclusions:

- a. Maximum effectiveness of the utilization of indigenous manpower from an over-all viewpoint has not been accomplished in South Korea.
- b. The language barrier is the major obstacle in the proper utilization of such manpower.
- c. Integration of indigenous personnel into US combat units is not desirable.

- d. Utilization of separate combat units is desirable provided sufficient personnel with bilingual ability are available and utilized.
- e. Adequate military training consistent with the exigencies of the times was received by the junior officers and recruits of the ROK Army.
- f. It is believed that indigenous manpower can be successfully and economically utilized for military purposes in any country, provided adequate planning is accomplished prior to the need for such utilization and that such plans are implemented and executed forthwith at onset of war under the guidance of trained and competent personnel.

6. Recommendations:

- a. Indigenous personnel should not be integrated with US combat units.
- b. Personnel quotas for the US Army language schools should be increased, with special emphasis given to the languages of those nations that are considered to be political danger spots.
- c. Broad plans, such as have been made in this study, for the utilization of indigenous manpower and the training of key personnel as conditions warrant, should be implemented as soon as possible.

7. Action Believed Taken by the Army on Basis of Study Results:

The Korean Service Corps (KSC) was established in July 1951. There were, as of November 1951, eighty thousand (80,000) indigenous laborers in the three corps, sixty percent (60 %) being KDCs and the remainder hired laborers. Well over fifty percent (50 %) of these were being used as cargo bearers and a large portion of the rest in digging fortifications.

8. Publications:

ORO-R-4 (FEC) Utilization of Indigenous Manpower in Korea
(SECRET)

9. Staff Members:

E. L. Atkins
H. P. Griggs

10. Subcontractors:

None

11. Consultants:

Roy T. Sessums
D. P. Noah

12. Plans for FY 53:

- a. Integration of contribution to FEC-ORO Field Project No. 8 by ORO field personnel working on other projects.
- b. Possible implementation of further specific field work on the KSC.

1. Project Name:

ORO-FEC, Project 8 (Special)

2. Assigned:

1 December 1950.

3. Status:

Completed 13 February 1951.

4. Mission:

The mission of this project was to investigate the North Korean People's Army's method of supply, to determine the means used in maintaining its logistical support, and to evaluate means of attacking this logistic system.

5. Major Conclusions:

- a. The North Koreans, by utilizing human porters and animal-drawn carts, were able to traverse mountain passes and little-used trails, thereby transporting supplies, ammunition and pack artillery to areas inaccessible by ordinary or "Western" means of transportation.
- b. Although rail and road networks had been and were under constant interdiction by UN Forces, the North Koreans continued to utilize these arteries of transportation by resorting to night movement of both trains and motor vehicles, supplemented by transloading, with human porters, at points where such arteries had been severed.
- c. Maximum use was made of captured material and supplies.

- d. UN air interdiction of the enemy lines of communication was effective during daylight hours, hence the enemy resorted ultimately to night movement of his supplies, men and material, utilizing dispersion and natural camouflage during daylight hours (Passive Air Defense).
- e. The North Korean Peoples Army did not effectively maintain its logistical support after the front became static and new areas were no longer being overrun.

8. Recommendations:

- a. UN Forces should examine all possible methods of reducing their own excessive logistic support in view of the much lower yet apparently successful logistic support of North Korean and Chinese Communist Forces.
- b. UN Forces should take a utilitarian viewpoint toward use of manpower in regions where indigenous manpower is plentiful.
- c. Interdiction of the North Korean and Chinese Communist Forces logistical supply systems should be augmented.

7. Action Believed Taken by the Army on Basis of Study Results:

- a. Supply units (transportation) have been formed making use of indigenous manpower.
- b. Transportation Corps (FEC) has initiated several new studies using this report as a basis for further study. (See Report prepared by Col Miller, Transportation Corps, FEC.)

8. Publications:

ORO-T-8 (EUSAK) North Korean Logistics and Methods of Accomplishment (SECRET)

9. Cost to 30 September 1951:

Cost not broken down for FEC Projects.

10. Staff Members:

E. L. Atkins
H. P. Griggs

11. Consultants:

Roy T. Sessums

12. Plans for FY53:

Additional studies to determine the level of interdiction required to deny the enemy (CCF & NKDA) stock piling capabilities are being pursued in cooperation with Transportation Corps in the FEC.

The methods used and the results obtained will be correlated by the Project TREMABASE for use in other areas of the world.

DEPARTMENT OF ARMY STUDIES

In addition to the Projects previously listed, ORO has begun research in some other areas of study in FEC at the request of The Department of the Army. Some are already in progress, some are to begin in the next few months, all will continue until terminated.

D/AS-1: Individual Records and Reports Systems:

It has been agreed that it would be profitable to investigate and analyze individual records and reports systems with a view toward improving existing or developing suitable organizations and procedures which will provide a flexible system to facilitate timely availability and accurate personnel data. It is contemplated that the research will include but not be limited to casualty reporting systems, pay records systems, and maintenance and accessibility of individual records. As soon as possible, there is a requirement to expand such a study to include records of all kinds. Although there are no personnel at the present time assigned to work on this study in the near future, this will be done as soon as possible.

D/AS-2: Combat Communications:

A study of communications in the infantry division is currently underway in Korea. This study will investigate the over-all problem and also examine special problems such as air-ground and infantry-armor-artillery communication. It is anticipated that conclusions will be reached and recommendations made concerning: (1) the need for communication equipment of new design; (2) the need for reorganization or modification of the present communication system; (3) measures for more efficient use of present equipment. This work is being done under subcontract with Technical Operations, Incorporated.

D/AS-3: Enemy Morale and Will to Fight:

Analysis not yet initiated.

D/AS-4: Fuel Economy Study:

The study on Fuel Economy contemplated for FY53 to be conducted in the Far East (FECOM) will consist of an investigation of the fuel distribution situation in the combat zone from the main Army supply point at Pusan up to the using units at the front. Vehicles of various types of operations such as combat, cargo carriers, administrative, etc., will be checked in an effort to determine vehicle fuel consumption. In addition to the investigation of the combat zone fuel problems, the theatre fuel distribution and consumption will be investigated.

D/AS-5: Weapons Effectiveness:

Selected units in Korea are being studied to assess small-arms efficiency. A tentative finding: Canadian forces have blended US and UK weapons into a system which appears superior to either. Also under study is the Belgian M2 FN rifle, the new light AP mine, and team-served vs individual weapons.

D/AS-6: Fatigue and Stress:

Acting on recommendations resulting from the fatigue symposium held in January 1952, Project DOUGHBOY is planning to (1) send a team of scientists to Korea to survey the fatigue-stress problem as it exists in combat; (2) continue with the preparation of a literature survey of the area of fatigue and stress; and (3) based on information obtained in tasks 1 and 2, prepare a report which would assist the army in attacking the fatigue and stress problem. In addition, fatigue and stress will be studied in the tactical laboratory.

D/AS-7: Air Interdiction:

Analysis not yet initiated.

D/AS-8: Parawarfare:

Recent Work in FEC. Fred Barton made an extensive trip investigating guerrilla warfare in three countries: Korea, Malaya, and the Philippines. A preliminary account of this work was published as

ORO-T-25(FEC), and ORO-S-39(FEC) "Summary of Activities on Guerrilla Warfare," dated 6 May 1952. Another summary has been prepared since Mr. Barton's return to Washington: ORO-S-257 "General Findings and Recommendations Re Paramilitary Warfare Derived from a Survey in Korea and Southeastern Asia." Mr. Barton is preparing three more Staff Memoranda describing the voluminous material he collected and brought back to Washington. His findings are of considerable interest to Project PARABEL since they permit the comparison of guerrilla warfare in the three different areas.

D/AS-9: Leadership and Combat Effectiveness:

A team of four (Drs. Weislogal, Gustad, Clemens, Kubany) from the American Institute of Research spent parts of the months of March and April in Japan and Korea collecting data on combat performance by the critical-incidents technique applied to US Army officers and enlisted men. In Korea, a total of 8,305 incidents were obtained from 1,526 respondents and in Japan 281 incidents from 56 respondents. Each of these incidents amounts to an example cited by the respondent of "good" or "bad" combat performance witnessed by him. They are being classified, along with 1,173 further incidents obtained at Fort Benning from officers and enlisted men recently returned from Korea, to determine more precisely what constitutes good combat performance.

Continued study of the data on combat performance under the AIR subcontract is planned.

Project SHOP plans to send a team of four to six persons to FEC for two or three months this summer for the study of: (1) optimum use of indigenous manpower in Korea (a sequel to ORO-R-4(FEC); (2) methods of training of CCF, NK, ROK, and UN troops in Korea; (3) Army requirements and supply of personnel with specialized knowledge of languages, foreign cultures, and foreign areas, using Korea as a pilot area; (4) the utilization of officers for combat duty in Korea.

D/AS-10: Occupation of Japan:

The first focus of attention in Project LEGATE has been an attempt to determine the realistic basis of the Army's responsibility in military government or civil affairs in order to clarify the necessity for adequate Army planning in this field. For this purpose, a

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D/A STUDIES

study was initiated in Korea which showed the imperative requirement and also the costs of lack of preparation. ORO-T-184, Civil Affairs in Korea, should be available for distribution about the end of June, 1952. This tech memo contains recommendations that further study be conducted in Korea concerning the Army economic aid program and concerning formal agreements with the Republic of Korea or the lack thereof. (A study of the economic data required to enable the Army to formulate effective economic management measures will be carried out in Washington this summer by Dr. Charles Henning who will be a temporary ORO employee).

Two LEGATE staff members are currently engaged in carrying out a detailed study of the purge of undesirable political elements in Japan following World War II. This study will include studies of the effects of the purge on economic and political activities at the prefectural as well as the national level. The incidence of the purge, violations of purge directives, and public opinion of the purge will also be studied.

D/AS-11: Effectiveness of Enemy Antiaircraft Artillery:

Collection of data on loss figures from 5th Air Force and Army aviation in Korea is in progress.

D/AS-12: Psywar Influence on North Koreans:

Analysis not yet initiated.